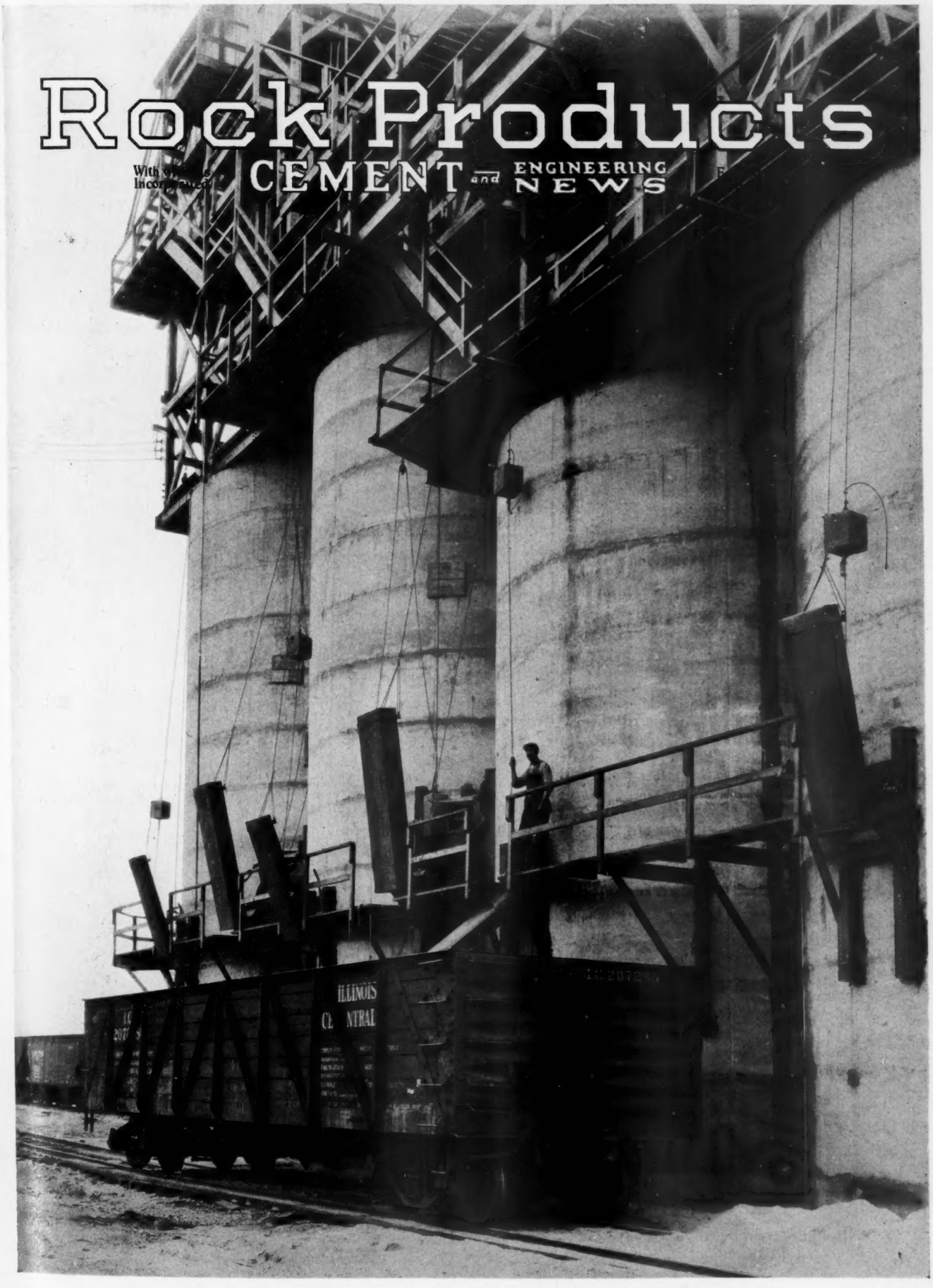
Volume XXXI Chicago, September 29, 1928 Number 20

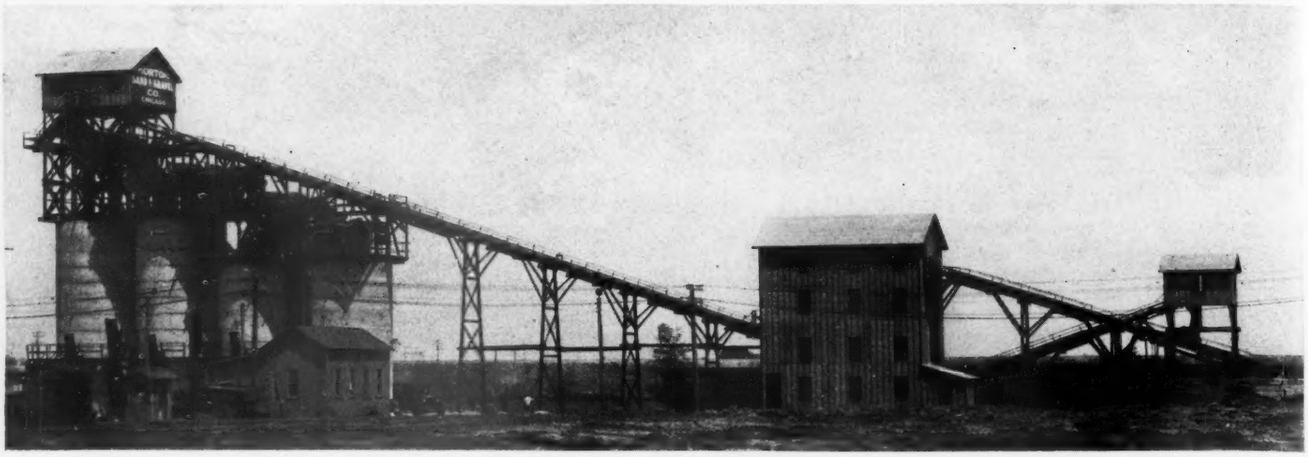
Rock Products

With [illegible] Incorporated

CEMENT and ENGINEERING NEWS



Reinforced-concrete bins with car-loading chutes at the new plant of the Morton Sand and Gravel Co. in the Chicago metropolitan district



The plant of the Morton Sand and Gravel Co., near Wayne, Ill., with crusher building at the right center and the washing plant at the left

New Dredging Operation in Chicago's Metropolitan District

Morton Sand and Gravel Co. Plant, Near Wayne, Ill., Uses Sump Method for Dewatering Its Pump Discharge

FROM time to time in the Chicago district a new sand and gravel plant adds its production quota to meet the requirements of the rapidly growing metropolitan area. The newest plant to be built to serve this market is the plant of the Morton Sand and Gravel Co., located near Wayne, Ill., 35 miles west of the center of Chicago, which started operations in May of this year. This plant, which is necessarily a dredge operation because of the lowness of the property, is particularly of interest because of the use of sumps for dewatering the dredge discharge. This is one of few such installations in the rock products field, one being at Denver and another being that of the Wolf River Sand Co. plant at Memphis, Tenn., which was described in the July 23, 1927, issue of ROCK PRODUCTS.

Uses Dredging Operation

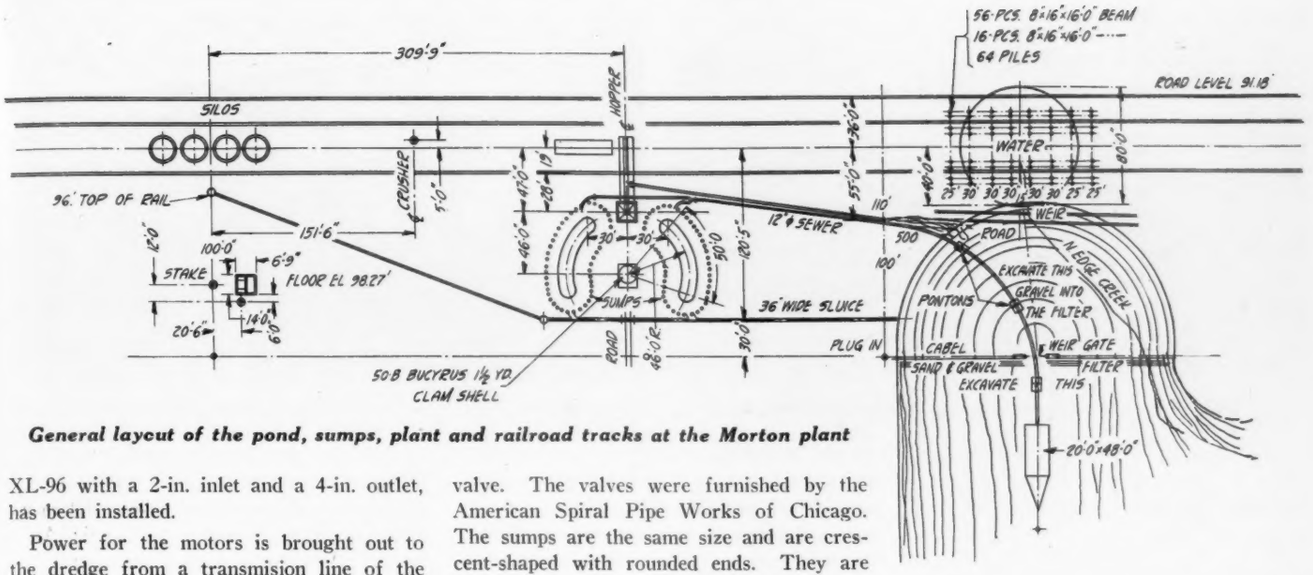
Some portions of the property are high enough so the company has considered excavating by shovel, but at present the dredge operation is the only method in use. Tests of the deposit have been made by sinking a number of test holes at different points over the deposit, and these have shown a uniformly good grade of gravel containing few large boulders. These wells were dug with an orange-peel bucket inside of a sheet iron caisson section, the weight of the sections carrying the whole casing down as the orange peel excavated. The sheeting followed within 2 in. of the bottom of the excavation at all times during the digging. By this method the wells were sunk to a depth of 32 ft. below the water level, the whole depth showing a good gravel.

The layout at this plant consists of a dredge pumping from a pond originally made by damming a small stream on the property, a pipe line to two sumps, and a screening, crushing and washing plant. The dredge is well constructed and excellently equipped, and the washing plant is of modern construction with reinforced concrete silos. The sumps are a development of the Stephens-Adamson Manufacturing Co. of Aurora, Ill., who were the engineers for this plant.

The dredge boat from the stern, showing the location of the transformers on the stern

The dredge is of wooden construction and is 24x48 ft. in size and 3 ft. in draft. A 300-hp. General Electric induction motor operating at 440 volts drives a Morris 12-in. centrifugal pump through a flexible coupling. The pump is rated at 4000 g.p.m. A Flory 3-drum hoist operated by a 15-hp. Westinghouse motor handles the suction. The operator's seat is conveniently located with control levers easily accessible and a depth gage on the wall before him. A stone box, approximately 30x24-in., is placed on the suction line.

There is a Morris 233-A centrifugal pump, driven by a General Electric 10-hp. motor, to supply circulating water and for priming the sand pump. A Penberthy ejector, No.

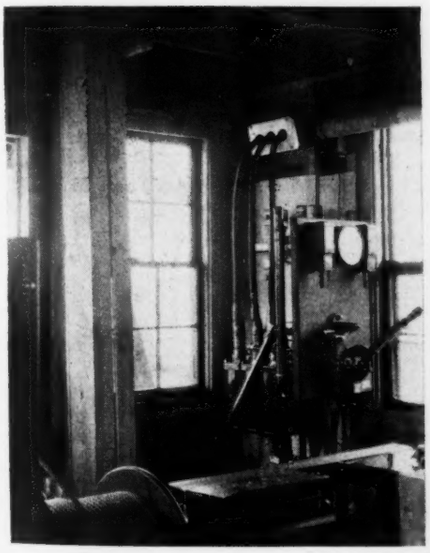


General layout of the pond, sumps, plant and railroad tracks at the Morton plant

XL-96 with a 2-in. inlet and a 4-in. outlet, has been installed.

Power for the motors is brought out to the dredge from a transmision line of the Public Service Co. of Northern Illinois on a 4000-volt line. A transformer located at the back of the dredge steps this current down to 440 volts. The cable to the dredge is rubber-covered and contains four lines. It was manufactured by Rome Wire Co. of Rome, N. Y.

A 12-in. line runs to the discharge at the sumps from the dredge, a distance of about 300 ft. at the present time. The raise to the discharge end is approximately 15 ft. above



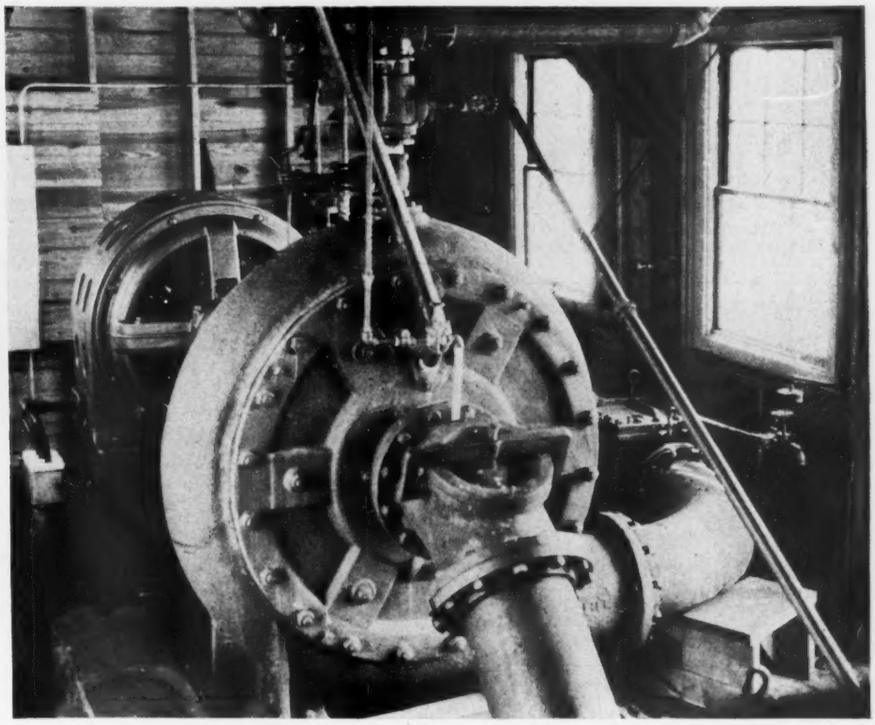
The pump operator's corner on the dredge, showing the controls and, to the left, the depth gage

the level of the water in the pond. The line is supported on both wooden pontoons and steel barrel pontoons, the latter having been made right at the plant, with considerable saving of money.

Sumps Used for Dewatering

The discharge is directed to one or the other of the two sumps through a Y, on each branch of which is placed a quick opening valve. The valves were furnished by the American Spiral Pipe Works of Chicago. The sumps are the same size and are crescent-shaped with rounded ends. They are so located that the curving center line of each sump is always just 46 ft. away from the central point, at which is located a revolving crane with a clamshell bucket. The sumps are so designed that the clamshell, which is a 1½-yd. Bucyrus with a 60-ft. boom can pick up the sand all along the length of the whole sump when operating on a 46-ft. radius, thus providing the largest area the crane can cover without moving. The sumps are constructed of timbers and old lumber embedded to considerable depth in the ground Approximately 1200 yd. are taken from a sump after it has been filled from the dredge, but this is not cleaning it out by any means. This method of dewatering allows the water to wash off over a weir and pass directly back to the pond, while the sand settles in the sump. A sump is filled in about half a day and it is possible to start taking the sand out as soon as the pumping to the sump is stopped.

The clamshell excavates the material from the sumps and deposits it in a concrete hopper, from which it is taken by a 30-in. underground belt conveyor to the foot of the belt conveyor to the crushing building. The first conveyor has a capacity of 300 tons per hour and the second has a capacity of 350 tons. Both were made by the Stephens-Adamson Manufacturing Co. as were all the other conveyors. The second is a 30-in. conveyor on 143 ft. 9 in. centers, and it carries



The 4000-g.p.m. centrifugal pump on the dredge boat driven by the motor, shown behind, through a flexible coupling

The dredge discharge entering one of the sumps

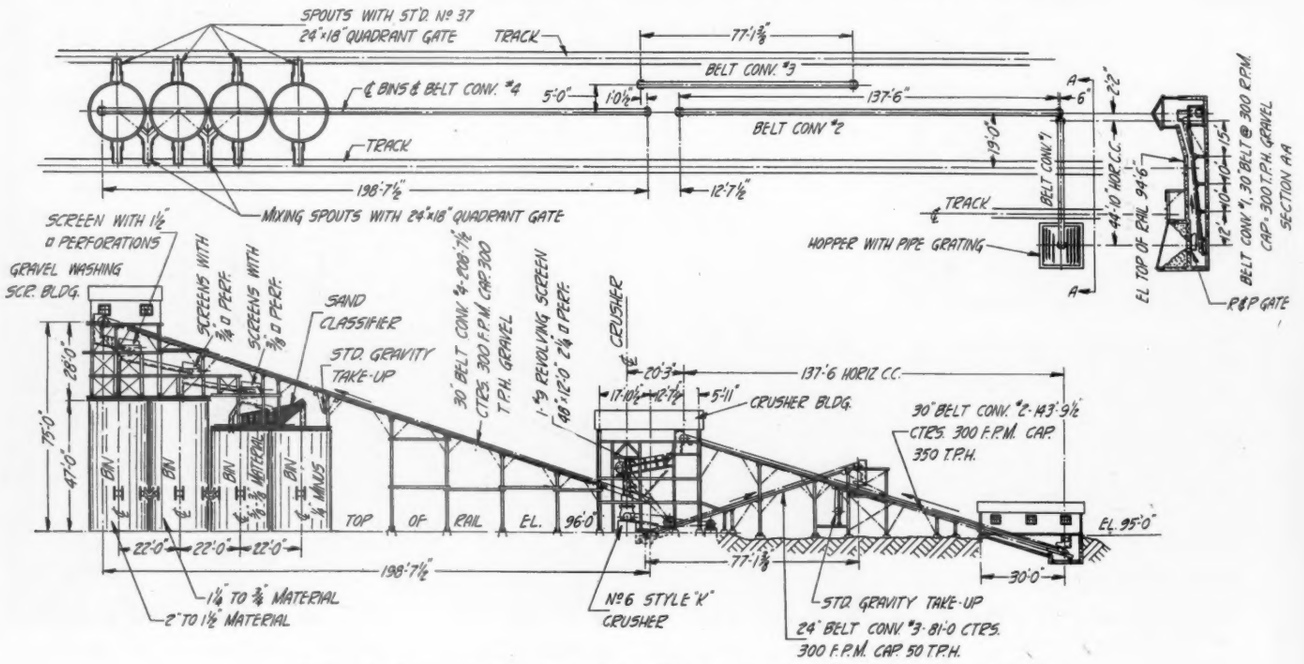
Changing the valves to shift discharge from one sump to other

all the material to the crusher building, where it passes to a revolving perforated steel plate scalping screen, 48 in. by 12 ft., with 2¼-in. square perforations. The conveyor is driven by a 40-hp. General Electric motor in the crusher building. The rejects from the screen drop to an Allis-Chalmers No. 6 gyratory crusher and the discharge is returned on a 24-in. belt conveyor to the 30-in. conveyor, which again delivers it to the scalping screen. Material passing through the scalping screen falls to a hopper which deposits it on a 30-in. conveyor that takes it to the top of the gravel washing and screening plant. A 50-hp. General Electric induction motor drives the crusher and primary screens through two belts, while a 40-hp. General Electric motor drives the head end of the long conveyor. There is a 5-ton Ford "Tri-bloc" hoist installed in the crusher building also.

At the washing and screening building the material is delivered to the first of three pairs of Gilbert revolving screens, all of which have square punched-plate perforations. The pairs are perforated 1½-in., ¾-in. and ⅜-in., respectively, and they separate the material into the sizes 1½- to 2-in., ¾- to 1¼-in. and ⅜- to ⅝-in. Below the last set of screens is a Stephens-Adamson drag type of sand classifier delivering the sand ¼-in. and finer to the fourth silo.

Water for the washing is supplied from the creek, and is pumped by a 1400-g.p.m. centrifugal pump manufactured by the A. S. Cameron Steam Pump Works of New York. A 60-hp., 440-volt General Electric

General dewatering arrangement with one sump in the foreground, one behind the clamshell, and the hopper at the left



General plan and elevation of the Morton Sand and Gravel Co. plant

Clamshell reclaiming the sand from one of the sumps

Dumping the sand to the hopper over the belt conveyor

motor drives the pump, which is located in a small pump house beside the stream.

There are four silos built with slip-forms by the Warford Construction Co. of North Aurora, Ill. They all are 22 ft. in diameter, outside, and the first two are 47 ft. in height, while the other two are 35 ft. high.

Gate underneath the sand hopper feeding to the first belt conveyor

Loading is by two spouts from each silo to a pair of tracks which parallel the centerline of the plant on either side. To one of these tracks there are two mixing spouts, one of which combines the 2- to 1½-in. material with the 1¼- to ¾-in. material, while the second combines the latter size with the ⅝- to ⅜-in. material. All the spouts are provided with 24x18-in. quadrant gates.

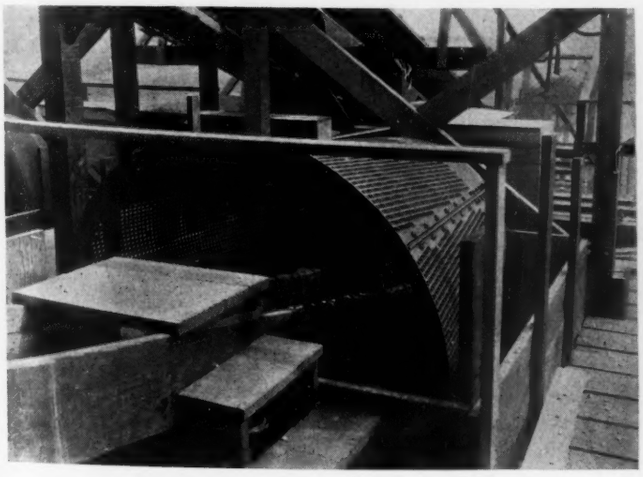
Shipping Almost Entirely by Railroad

The Morton company has about 3200 ft. of siding track, connected at the north to the main western line of the Illinois Central railroad. The plant also lies only a short distance from the line of the Elgin, Joliet and Eastern (Chicago Outer Belt Line) and it is expected that a direct connection will be made to this road in the future. A little farther away are the Chicago and Northwestern, and the Chicago, Aurora and Elgin electric line and it may be possible to obtain a physical connection with one or both of these.

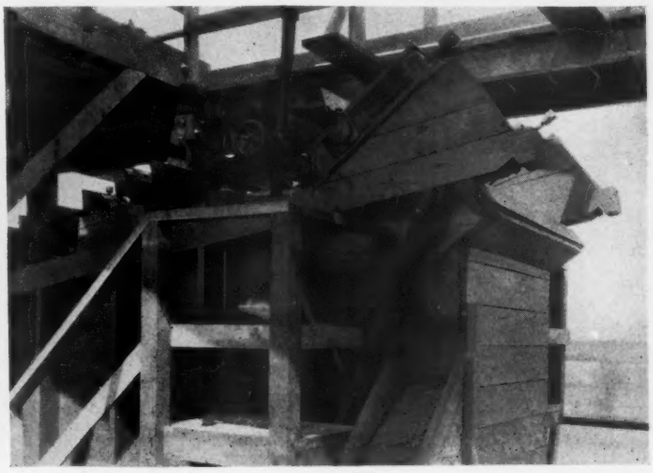
Batching Bins

During September two bins were set up on the highway beside the plant for batch loading of trucks. Each of these bins is of 50 cu. yd. capacity, one being for sand and the other for gravel. They were furnished by the James B. Seaverns Co. of Batavia, Ill., and are each fitted with an adjustable batch box which can be set to furnish any batch required by the contractor. Most of the batched material is to be used for highway work, as there is quite a large program of road building in the vicinity of the Morton plant, including the new North Ave. superhighway between Chicago and the Fox river valley, which passes two or three miles to

Arrangement of belt take-up at the Morton plant



The revolving screens at the washing plant



The drag type sand classifier at the Morton plant

the south of the plant. At the time the plant was visited, the highway contractor was receiving a "5-bag" mix composed of approximately 13 cu. ft. of sand and 22 cu. ft. of gravel.

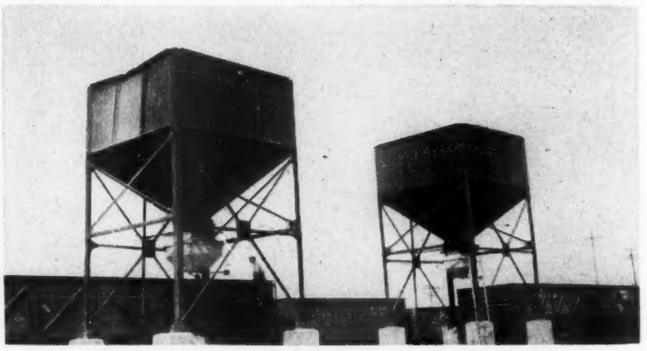
At approximately the same time that the new bins were installed, a new shovel-crane, made by the American Hoist and Derrick Co., was delivered. This has a 1-yd. bucket and is on caterpillar treads. It is to be used for loading to the bins and also for stock piling. A railroad siding runs on one side of the bins (with the main road on the other side) and the new crane unloads the material from cars on the siding to the bins or to piles beside the track where it can later be reclaimed with no loss of time.

The longest belt in the Morton plant between the crusher and the washing plant

Stripping an Asset

Another new outlet for the company's output is the sale of the black earth overburden, which has to be stripped from the gravel deposit. The Kanst-Moriarity Black Earth Co., contractors in excavating and filling, are removing the overburden and shipping it to Grant Park on the Chicago lake front, where it is to be used as a top covering over the sand fill that is being made there. This company has taken advantage of the fine quality of the earth on the Morton property and of the easy access furnished by the Illinois Central railroad and is shipping out the dirt as fast as it can be stripped from the ground.

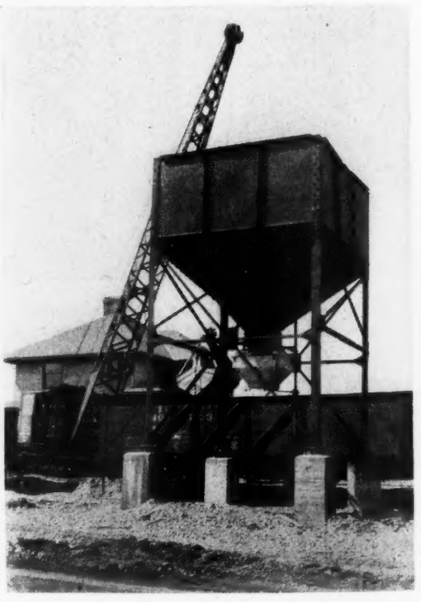
A siding has been built from the main line of the I. C., which runs directly beside the property, to a place where the stripping is being done and a simple runway has been built up beside the track so that the trucks can dump directly to the cars. Fred Hillquist, contractor of Geneva, Ill., has the sub-contract for removing the stripping. Since the Illinois Central is the only railroad that runs directly to Grant Park in Chicago, the arrangement is an excellent one for the Kanst-Moriarity company, and an advantage to the Morton company, as it is being paid for having its stripping done.



Two new batching bins for sand and gravel at the Morton plant

Batching box below one of the bins

This plant was entirely completed within seven months after breaking ground. Stephens-Adamson Manufacturing Co. was the engineer. Geo. H. Hartong is general manager of the company, which has its general offices at 208 West Washington street, Chicago. Mark Morton is president of the new concern. Joy Morton, his son, has been put in charge of the plant as superintendent.



Crane filling one of the batching bins

The outfit being used to strip black earth from the Morton property for use in a Chicago park

The ramp beside the railroad siding at the stripping operation, from which trucks dump directly to the cars

An American Pozzolana and Its Effect on Portland Cement Concrete

Pumicite—a Volcanic Ash Found in Kansas and How It Is Being Exploited

By Dr. E. Lee Heindenreich
Consulting Engineer, Kansas City, Mo.

FOR CENTURIES the engineering and industrial world seems to have lost sight of the fact that pozzolana, or pozzolan cement, was known and successfully used by the Romans and their contemporaries to improve workability, strength and durability in their mortars.

In the summary of "British Research on Lime and Lime Mortars" (ROCK PRODUCTS, October 15, 1927), we find: "The ancient Greeks and Romans had found that the clayey or silicious matters do not need to be already present as an ingredient in the limestone before burning, but can be added subsequently, provided only that these additions are 'pozzolanic.' Then the mortar resulting from the admixture of pozzolanic material with slaked lime and sand will show marked hydraulic properties and a development of considerable strength on setting, independent of any slow and uncertain process of carbonation, even though a fat, non-hydraulic lime had been used.

"In spite of the competition of artificial portland cement, such pozzolanic limecements are still prepared, and have been used on a large scale outside Great Britain (particularly in districts where a good pozzolana is available) in massive works where the ultimate degree of mechanical strength is not called for and where cost of production is an important item."

A comparatively greater strength was produced by the introduction of portland cement, but it has been known for 30 years or more that only 40 to 45% of the portland cement in mortars and concrete is efficient, and that 55 to 60% remains inert and unhydrated.

Some Old Research

Dr. William Michaelis in Berlin in 1895 in his "The Behavior of Hydraulic Cements in Sea Water" stated: "It is easily understood that a body in which so considerable a quantity of active lime becomes liberated cannot be, in the chemical sense, a *stable compound*. The free lime must work and react until, in one way or another, it forms a saturated compound. This occurs first from the surface downward, by the absorption of carbonic acid, when the cement is exposed to the air or to water containing carbonic acid; and after such a consideration it may be concluded *a priori* that if there is offered to the lime, while it is in process of separating out, pozzolanas (such substances which, in combination with calcium hydrate, form cement), the amount of effective cement in the mortar may be increased in such a way that no more caustic lime can be deposited in crystals, but that the entire quantity of calcium hydrate is employed in the formation of calcium hydrosilicate and aluminate."

In 1906, Bertram Blount, F.C.S., read a paper on cement manufacture in which he stated: "Most limes and cement are liable to show deterioration after reaching their maximum tests, but when trass is used as an admixture this does not occur. Trass is invaluable to rectify the dangers of portland cement which contains an excess of free lime, as also to secure a perfect quality in the standard of portland cement."

Prof. Dr. Ing. A. Kleinlogel states in "Einflüsse auf Beton, 1925," p. 156: "To prevent deterioration of cement and concrete due to injurious chemical action in ground water, it is always recommendable to use a dense mixture with trass as admixture and further to protect the surface by bituminous paint."

In the summary of "British Research on Lime and Mortars" we further find: "When used with cement concrete, the admixture of trass has the effect of strengthening the mix and causes it to assume a condition of induration in the center with equal rapidity to the surfaces, which are exposed to the action of the atmosphere, thus preventing superficial fractures by expanding and shrinking movements, caused by the lime particles striving for combination with carbonic acid from the atmosphere."

As a matter of fact, it has been observed that concrete floor, wall and pier surfaces, as well as pavements, in which pumicite has been incorporated, have been noticeably free from hair cracks, crazing or even through cracks.

According to the department of scientific and industrial research by the Building Re-

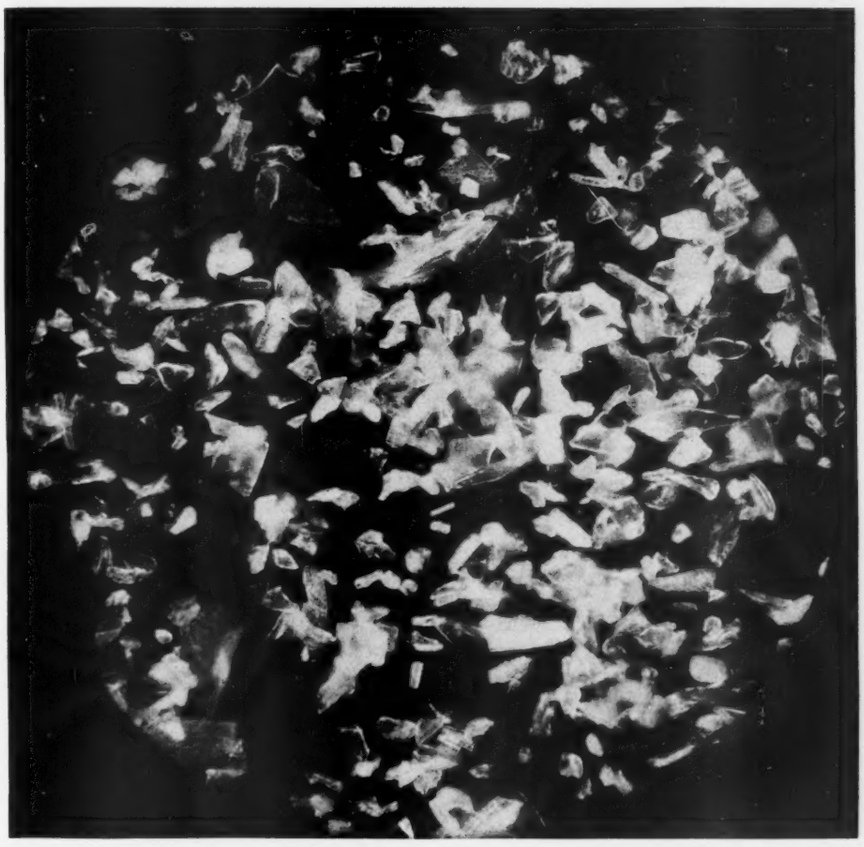


Fig. 1. Pumicite magnified 500 times showing how it is composed of finely divided angular grains of volcanic ash

Fig. 2. A typical pumicite deposit from which the overburen has disappeared by errosion

search Board of Great Britain, a definition of pozzolanas is as follows: "A substance is said to be pozzolanic when, while not necessarily cementitious by itself, it possesses constituents which will combine with hydrated lime at ordinary temperatures in the presence of moisture to form stable insoluble compounds of cementitious value. When mixed with lime mortar in addition to, or in partial substitution for, sand, it will impart hydraulic properties and greater strength."

Set portland cement contains free, slaked lime and this compound is very easily attacked by many chemical substances, and is the cause of most of the efflorescences on cement products.

The addition to cement of a material capable of combining with the free lime renders it much less affected by the action of various chemically destructive agencies. A comparison between the elements contained in portland cement, volcanic ash (pumicite) and various other pozzolanas follows in Table 1.

In Table 1 will be seen that 11 of these admixtures are more or less pozzolanic in their composition and that pumicite, within its range of analyses, contains the nearest conditions for an average pozzolana. Pumicite is the only one of these admixtures which, in nature, appears in powder form and that has not been subjected to any cementation. Trass, diatomite and tripoli are quarried, crushed and ground, while pumicite is mined as a powder, kiln dried, so as to remove moisture and carbonates and screened or air-separated so it can be used as extremely fine material for fillers in soaps, asphalts, etc. For mortars and concretes, the fineness selected is from 70 to 80% through a 300-mesh, while portland cement is between 80 and 90% through 200-mesh.

Fig. 1 is a photograph of pumicite about 500 times magnified, showing that it consists of a finely divided powder or dust made up of small, sharp, angular grains of volcanic glass. It is formed by the violent and explosive eruption of volcanoes which throw out this dust in great clouds. Ultimately the dust settles many thousands of miles from its original source and forms the beds of pumicite. Although apparently of the same composition, pumicite should not be confused with pumice, which is found in solid, coherent blocks, which, when dry, will float on water; that is, the apparent specific gravity is less than one. The specific gravity of pumicite is about 2.16.

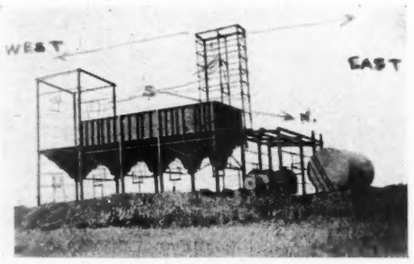


Fig. 3. Pumicite refinery at Anthony, Kan., during construction

TABLE 1

	Plain portland cement	Nettertaler trass	Range of pumicite		Hokatoshu	Average of 31 samples of Pozzolana	Diatomite	Tripoli
SiO_2	19 —25%	55.34	66.74	70.34	43.63	42.66	92.5	91.61
Al_2O_3	5 — 9%	19.42	16 15	3.48	25.48	15.17	1.5	1.5
Fe_2O_3	2 — 4%	5.6	3.16	3.97	12.29	4.19	....	2.22
CaO	53 —65%	3.02	3.05	4.40	0.52	3.7	....	0.28
MgO	0.5— 4%	1.53	1.20	1.95	0.60	5.7	....	0.29
Ka_2O	0 — 1%	4.68	0.39	4.81	.....	....	....	.....
Na_2O	0 — 1%	.....	0.33	4.11	.....	....	....	.....
SO_3	1 — 1.75%	.....	.....	0.99	0.19	....	....	.....
TiO_2	.....	.....	0.64	.....	.....	....	....	0.1
Loss ignition	.....	7.61	8.34	5.96	.....	4.9	....	.....

The greatest deposits of pumicite in the United States are found in the states of Kansas, Nebraska and Oklahoma, where the overburden is sufficiently shallow for economic production. California, Wyoming, Utah, Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, South Dakota and Washington have deposits more or less inaccessible, due to overburden and transportation difficulties. Fig. 2 shows a typical pumicite deposit where the overburden has gradually disappeared by erosion. Fig. 3 shows a pumicite refinery at Anthony, Kan., during erection, with kiln hoppers and screening towers. Fig. 4 shows an exterior view of the same plant, operated by the Pumicite Co., St. Louis, Mo. Similar plants are in progress at Hoxie, Fowler and Wilmore, Kan., with a refining plant at East St. Louis, Ill.

Theory of Pozzalanic Action

Figs. 5, 6, 7 and 8 show typical photomicrographs of concrete test cylinders where the mix contained pumicite and where it did not.

Greater enlargements were made, but at the expense of clearness, no doubt special microscopes may be used to extend the clear zone.

A more persistent research in this direction may be fruitful of more conclusive observations than have been made by the physiochemical researches during the last decade. From the results so far gained by the use of pumicite as an admixture or part substitution in cement we cannot draw but one conclusion—a correct quantity of pumicite in a concrete mix will increase its

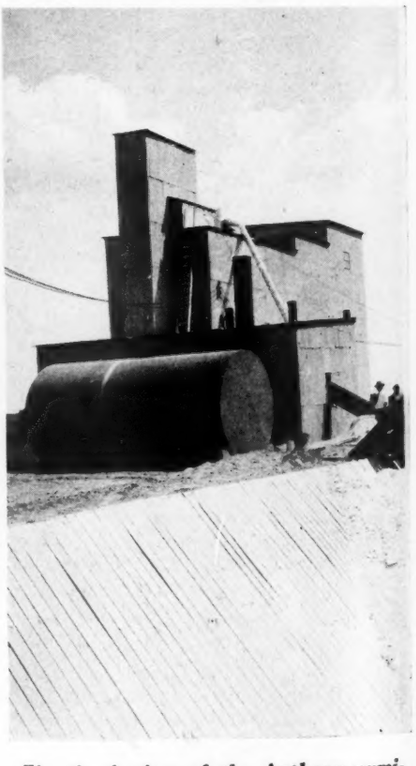


Fig. 4. A view of the Anthony pumicite plant after completion

Fig. 5. Photomicrograph of mortar containing a pozzolana

strength and durability, hence reduce the cost of maintenance.

Another thought:

Newly discovered facts in the subatomic theory have formed a basis for continued and gradual alterations in the advance of knowledge. If we examine the Mendeljeff periodic table we cannot avoid noting the peculiar grouping of atomic numbers of the constituents of cement and pozzolana and their atomic weights. We have:

	Atomic number	Atomic weight
O	8	16
Na	11	28
Mg	12	24.32
Al	13	26.06
Si	14	28.06
S	16	32.07
Ca	20	40.07
Fe	26	55.84

With the atomic numbers representing the chemical properties and net nucleur positive charges and the *difference* between *weights* and *numbers* representing the negative electrons of each element, might not the close grouping of all the elements and pozzolanas suggest to the physicists some new explanation of the final formation of tricalcium aluminate, tricalcium silicate and dicalcium silicate under the phenomena of hydrolysis?

Test Results

Tables 2 and 3 give the results of tests to determine the most advantageous amount of pumicite to add to the mix. In the tensile strength tests in Table 3, there is a comparison of 10% substitution of pumicite in the neat portland cement and a 10% substitution in 1:3 portland cement with standard Ottawa sand, showing a minimum increase in strength up to 48 hours of 10.5%, the same water-cement ratio being maintained.

At the construction of the Larabee grain elevator in Kansas City, of which the writer was consulting engineer, the contracting engineer had specified 5⅓ bags of cement per cubic yard, and here 10% of the cement was substituted by pumicite, so that 4¾ bags of cement per cubic yard was used instead. Simultaneously the same contractors with exactly similar equipment built another million bushel grain elevator in Kansas City, using 5⅓ bags cement per cubic yard.

Table 4 shows the result of the Larabee elevator with 4¾ bags cement and 1 bag pumicite, while Table 5 shows the results in one year with the other elevator with 5⅓ bags cement. A third elevator was built in Kansas City directly afterwards by the Washburn-Crosby Co., and here 5 bags of cement and 1 bag of pumicite were used, with always the same water-cement ratio as the other two: 7 gal. of water per bag of cement, including whatever absorption the pumicite would require.

Table 6 shows the result of tests at the Washburn-Crosby elevator in one year, and

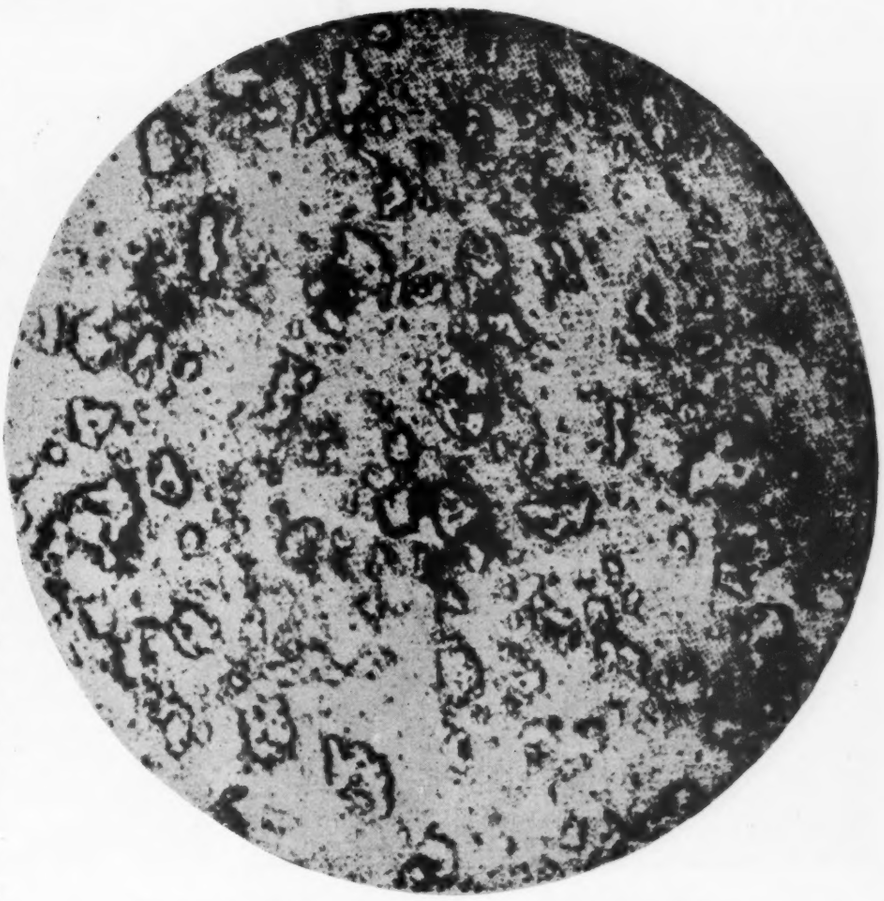


Fig. 6. Photomicrograph of mortar containing no pozzalana

TABLE 2.—AMOUNT OF PUMICITE THAT CAN BE USED TO THE BEST ADVANTAGE

Laboratory No. 98,472

		Plain Mortar Specimens			
		6x6-in. cyl.	sq.in.	6x6-in. cyl.	sq.in.
1 part cement, 3 parts sand	7 days	36,510	1291	38,040	1345
	28 days	57,090	2019	55,980	1980
	60 days	62,325	2236	62,760	2220
0.8 part cement, 3 parts sand	7 days	20,440	723	20,830	737
0.2 part volcanic ash	28 days	44,880	1587	44,560	1576
	60 days	52,110	1840	52,300	1850
0.9 part cement, 3 parts sand	7 days	51,310	1815	45,470	1608
	28 days	74,000	2617	73,600	2603
	60 days	48,730	2786	79,030	2796

Note the quantities here are expressed in terms of volume. These tests seemed to indicate that about 10% by volume was the most efficient, and, therefore, tension tests were made accordingly.

TABLE 3

NEAT PORTLAND CEMENT

Tensile Strength (lb. per sq. in.)

	6 hours	9 hours	12 hours	18 hours	24 hours	36 hours	48 hours
Average	48	103	148	263	313	345	413

NEAT PORTLAND CEMENT (10% PUMICITE ADMIXTURE)

Tensile Strength (lb. per sq. in.)

	6 hours	9 hours	12 hours	18 hours	24 hours	36 hours	48 hours
Average	60	117	255	307	358	393	460

1:3 PORTLAND CEMENT, STANDARD OTTAWA SAND

Tensile Strength (lb. per sq. in.)

	6 hours	9 hours	12 hours	18 hours	24 hours	36 hours	48 hours
Average	63	97	123	160	198	263	310

1:3 PORTLAND CEMENT, STANDARD OTTAWA SAND

(10% of cement replaced with pumicite)

Tensile Strength (lb. per sq. in.)

	6 hours	9 hours	12 hours	18 hours	24 hours	36 hours	48 hours
Average	73	107	145	183	227	300	343

the uniformity in this case is simply astounding when compared with the plain concrete shown in Table 4.

Fig. 9 shows a graphic comparison of the uniformity of concrete in these three constructions, each of more than 10,000 cu. yd. of concrete, plainly showing the beneficial effecttoward uniformity, caused by the introduction of pumicite. It should be added that while the drawforms of the plain concrete elevator was lifted at the rate of 8 ft. in 24 hours, the pumicite concrete elevators averaged nearly 13 ft., largely due to the greater workability obtained.

Almost parallel results were obtained in Germany when trass, a pozzalana, owing to its comparative cheapness, was substituted for cement or lime in concrete and lime mortar. Fig. 10 shows tension test results of a 1 cement to 3 sand mortar compared with 50% trass and 50% cement to 3 of sand, and with 40% trass and 60% cement to 3 of sand mortars.

Fig. 11 shows compressive stresses in 1 cement, 3 sand and 6 gravel, and 1 cement, 4

TABLE 4.—LARABEE ELEVATOR

Mix—4¾ bags cement, 40 lb. pumicite to 1 cu. yd. finished concrete. 6x8-in. cylinders.

Lab. No.	7 da.	28 da.	60 da.	6 mo.	1 yr.
101,754	1736	2270	3514	3187	3650
	1768	2104	3352	3245	3748
	1807	2553	3258	3532	3456
	1795	2269	3278	3432	3372
101,636	1511	2312	3024	3726	3367
	1525	2416	3062	3942	3631
	1466	2442	3117	3778	3501
	1486	2440	2963	3883	3357
101,497	1548	2020	2923	3826	3380
	1607	2095	2809	3752	3750
	1552	2165	2887	3970	3246
	1591	2142	2970	3760	3912
10,128	3593	3392	.....	4062	4273
	2488	2973	.....	4149	4245
	Plain concrete, 5½ bags cement				
	Foundations				
100,959	2304	2577	.....	2525	.....
	Drawforms				
101,778	1235	2652	1706	3578	2710
	907	2629	1517	3524	2835
	890	2045	2144	3446	2390
	1265	2142	1865	3504	4111

TABLE 5.—A MILLION-BUSHEL ELEVATOR BUILT WITH PLAIN CONCRETE

(Kansas City Testing Laboratory Tests)

Lab. No.	7 da.	28 da.	60 da.	6 mo.	1 yr.
101,832	1600	2179	3447	1637	2146
	1719	2193	3226	1403	2837
	1553	2118	3587	1368	1967
	1645	2146	3473	2015	1556
101,994	1424	2121	1182	3138	3525
	1584	1384	1361	2503	1932
	1470	1260	3902	2010	2100
	1671	1372	3045	2051	2433
101,995	1789	1741	2522	2547	3256
	1121	2817	3024	3152	4132
	1621	2658	2009	2685	3735
	1555	2692	2425	2570	3536
101,996	1091	2112	3195	2731	1581
	1209	1950	2082	3134	2019
	1064	1695	1565	2378	1577
	1298	1291	1781	2694	2004
101,987	1378	1949	2355	1793	3074
	1000	1543	2255	1544	1933
	1003	2178	1922	1437	1816
	1384	1556	2216	2401	2072

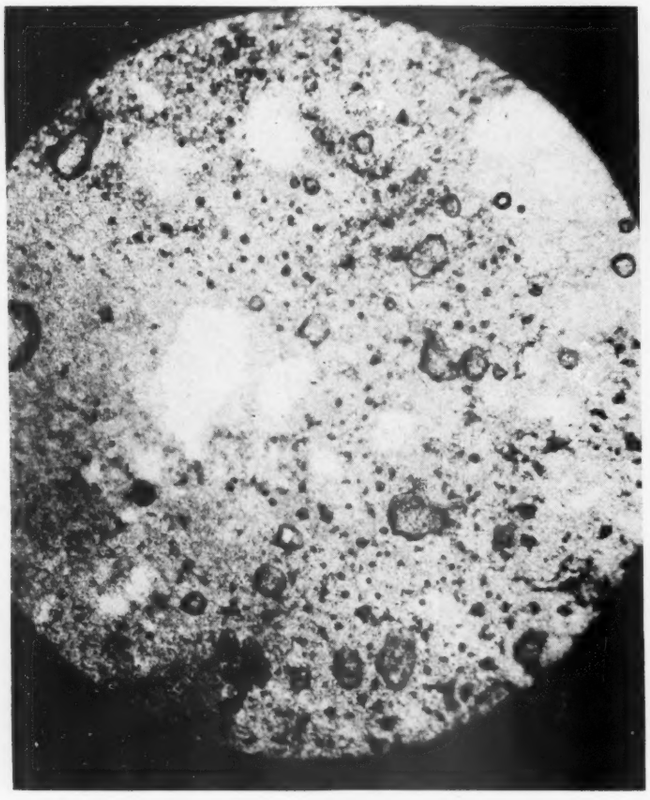


Fig. 7. Photomicrograph of mortar containing 6 sacks of cement per mix

Fig. 8. Photomicrograph of mortar containing 5 sacks of cement and 1 of pumicite per mix

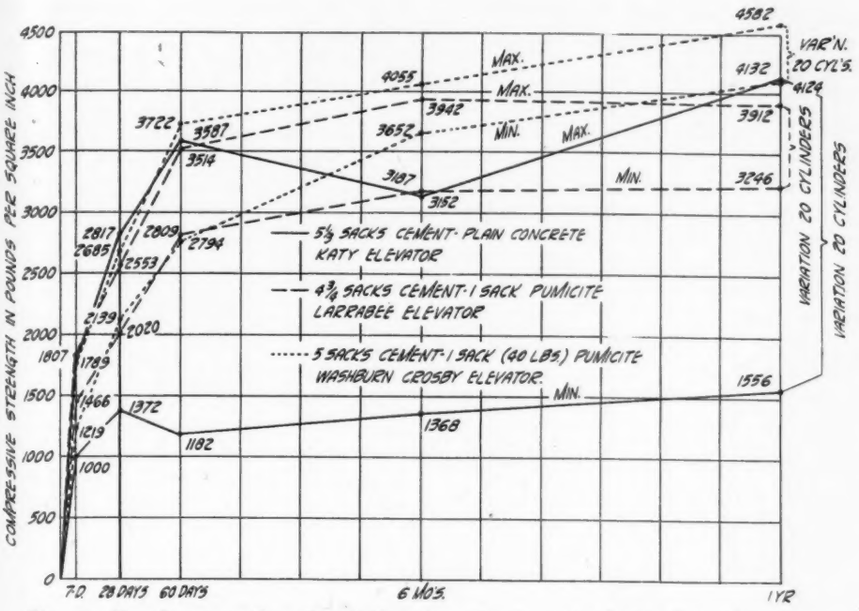


Fig. 9. Graph comparing the uniformity of concrete obtained in three constructions, in two of which pumicite was used

TABLE 6.—COMPRESSION TESTS OF WASHBURN CROSBY ELEVATOR KANSAS CITY

(Kansas City Testing Laboratory, Kansas City)
Pumicite with portland cement.

Mix—5 bags cement, 40 lb. pumicite, sand, crushed rock, water. All cylinders 6x12-in.

Lab. No.	7 da.	28 da.	60 da.	6 mo.	1 yr.
105,143	1447	2612	3032	3834	4213
	1372	2670	2794	3840	4464
	1472	2477	3237	3790	4137
105,170	1370	2685	3587	4007	4574
	1413	2512	3471	4055	4488
	1312	2658	3722	3972	4582
	1379	2568	3676	3928	4421
105,220	1275	2316	2979	3913	*
	1155	2342	3185	3836	*
	1210	2482	3018	3960	*
	1197	2445	3155	3825	*
105,405	1291	2298	2978	3943	4393
	1219	2139	3059	3863	4273
	1250	2391	2835	3652	4280
	1236	2412	2908	3867	4268
105,418	1736	2759	3183	3915	*
	1765	2668	2993	4058	*
	1804	2722	3176	3965	*
105,420	1785	2569	3580	3895	4159
	1733	2650	3454	3829	3124
	1915	2537	3505	3856	4251
105,785	1588	2263	2887	3675	*
	1422	2267	2560	3594	*
	1452	2498	2723	3572	*
	1490	2425	2797	3546	*

*Not yet due.

sand and 8 gravel compared with an admixture of trass to the cement in concrete mixes of a more lean composition. The trass substitutions invariably show greater strength. These tests were made at the Ems, Germany, waterworks, under the direction of the government engineer, Herr Helbing, Essen.

Investigations with careful experiments and tests are now going on regarding the use of pumicite in brick mortars, on the same principle that pozzolanas are successfully being used in Europe in taking advantage of the materials used by the old Greek and Roman constructors.

The greatest consumers of cement in the United States are the highway departments, and extensive experiments and tests are being made by several states within economical reach of the pumicite production to investigate the benefits of introducing a pozzolana like pumicite into their highway concrete practice. The results of preliminary tests made under similar conditions for 1:2:3½ concrete, by the Missouri and the Iowa departments, are indicated in Tables 7 and 8, and further tests are under way to investigate to what extent pumicite will reduce hair cracks or through cracks in the pavement.

Another hypothesis for the remarkable addition to strength in concrete where pumicite is added as a part substitution or an admixture is that, owing to its fineness and sharpness, it doesn't act as a repellent but cuts the

TABLE 7—CYLINDERS MADE JANUARY 23, 1928, BY MISSOURI HIGHWAY LABORATORY, JEFFERSON CITY, MO.

Plain cement concrete	Mix by volume	Mix by weight	Water gal. per bag	W/C ratio	Slump	Combined F. M.	7-day comp. strength	28-day comp. strength	90-day comp. strength
	1-2-3½	1-2.34-3.48	6.29	0.735	2¾-in.	5.64	1900	3450	4970
							1915	3470	4670
							1900	3010	4110
							2050	3140	3930
							1830	3025	4350
							1775	3040	4140
							1895 Av.	3189 Av.	4445 Av.
10% pumicite substituted for 10% cement. Water absorbed by pumicite considered to be 20% of its weight.	1-2-3½	1-2.34-3.48	6.62	0.735	¾-in.	5.64	1900	3600	4110
							1360	3370	4020
							1630	3450	5160
							1825	3650	4120
							1825	3005	4520
							1865	3935	4030
							1734 Av.	3318 Av.	4327 Av.
10% pumicite Admixture. Water asborbed by pumicite considered to be 20% of its weight.	1-2-3½	1-2.34-3.48	6.52	0.735	1¾-in.	5.64	1890	3500	4830
							1185	3650	4400
							1970	3650	4780
							1790	3300	4220
							1840	3250	5120
							1806	3260	4050
							1747 Av.	3435 Av.	4567 Av.

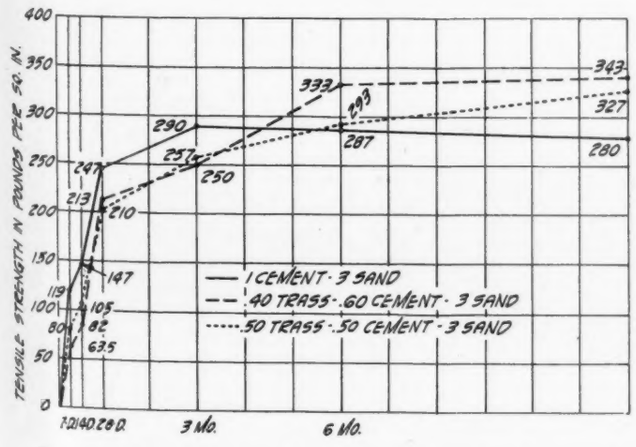


Fig. 10. Tension tests of a 1:3 sand mortar compared with mortars containing stated quantities of trass replacing some cement

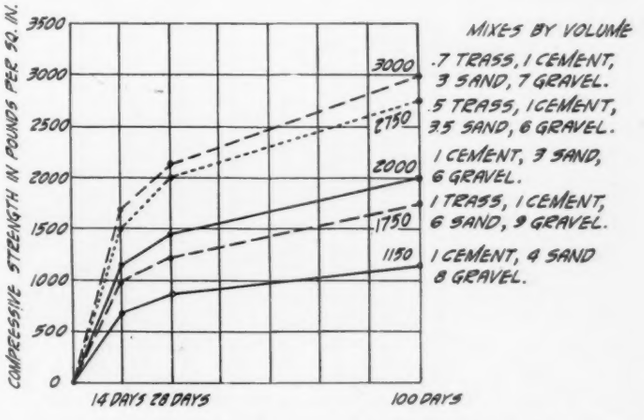


Fig. 11. Compressive tests of 1:3:6 and 1:4:8 mixes of concrete compared with concrete containing some trass replacing some cement in leaner mixes

TABLE 8—IOWA STATE HIGHWAY DEPARTMENT RESULTS OF COMPRESSION TESTS, MARCH 5, 1928

Admixture "A"

Plain concrete	7 days	Av.	28 days	Av.
Mixture—1 :1.71 :3.47 by weight	1980	.....	2565	.....
	1288	.....	1499	.....
Water—5.5 gal. to 94 lb. cement	1490	1586	3010	2358
	1423	.....	1690	.....
Slump—7. in. Flow—230	1117	.....	2400	.....
Batch weights:	1423	1321	2500	2197
Cement—94.0 lb.				
Sand—160.7 lb.				
Gravel—326.2 lb.				
Water—45.9 lb.				
10% pumicite addition to cement				
Mixture—1 :1.71 :3.47 by weight	2490	.....	3652	.....
	1840	.....	3561	.....
Water—5.5 gal. to 94 lb. cement	1886	2072	4000	3738
	2130	.....	3160	.....
Slump—3 in. Flow—170	1552	.....	2870	.....
Batch weights:	1816	1832	3460	3163
Cement—94.0 lb.				
Pumicite—9.4 lb.				
Sand—160.5 lb.				
Gravel—326.0 lb.				
Water—46.0 lb.				
10% substitution for cement of pumicite				
Mixture—1 :1.71 :3.47 by weight	1540	.....	2955	.....
	2250	.....	2876	.....
Water—5.5 gal. to 9.4 lb. cement	2127	1972	4240	3557
	2020	.....	2040	.....
Slump—½ in. Flow—126	2340	.....	4800	.....
Batch weights:	1854	2071	2820	3220
Cement—84.6 lb.				
Pumicite—9.4 lb.				
Sand—160.5 lb.				
Gravel—326.0 lb.				
Water—41.3 lb.				

surface tension of the water and holds and stores the moisture absorbed, only to release it gradually, to assist in hydration of the cement, thus forming minute storage reservoirs in the mortar available after the first hydration has set in. There may be some catalytic action affecting the elements composing the pumicite (which are the same as those existing in cement) in the presence of moisture, so that these elements co-operate in some way. In this connection it is interesting to note that the atomic numbers of the elements in cement and pumicite are very closely grouped, being soda 11, magnesia 12, aluminum 13, silica 14, sulphur 16, calcium 20 and Iron 26, while the whole range of atomic numbers runs from 0 to 92. These atomic numbers represent the chemical properties and the net nuclear positive charges, and with the entering of the physicists upon the realms of chemistry, might not this close grouping of these active elements suggest to the physicists some new explanation of the phenomenon of either hydrolysis or hydration?

An Opportunity For Extensive Research

A more persistent search in this direction, a careful investigation of thin sections under polarized light, might be fruitful of more constructive observations than have been made by the physio-chemical researches of the last decade.

The realization of the importance of the water-cement ratio law, the temperature effect and, last but not least, the proper mixing time, have, in the last decade, contributed greatly toward producing a workable and durable concrete and, surely, the "fool-proof" results acquired by the introduction of pumicite will lead to a still greater progress toward safeguarding concrete for durability.

Volcanic Ash Resources of Kansas

THE STATE GEOLOGICAL SURVEY of Kansas has just issued Bulletin 14 on the "Volcanic Ash Resources of Kansas," by Kenneth K. Landes. The bulletin is of special interest to ROCK PRODUCTS readers because it is quite a comprehensive treatise on a little known and little exploited rock product, but one that seems destined to play an important part in the manufacture of cement, mortars and concrete in the years to come.

Volcanic ash, according to this report, is composed of excessively fine glass or lava fragments. It is produced by volcanoes, but due to the lightness of the individual particles it may be carried by the wind many hundreds of miles from its source. A great number of names have been used for this material. Among them are volcanic dust, pumice, pumicite, geyserite, silica and feldspar. Because volcanic ash is not a product of combustion, a number of geologists object to the word ash. But the term predominates in literature and is defined in the dictionaries, so it is preserved. Pumice refers to larger vesicular rock-glass fragments of similar composition and origin. When ground it has very similar properties to volcanic ash. Geyserite is mineral matter deposited by geysers about their vents, and this term was applied to volcanic ash deposits in Nebraska when they were first discovered and their origin misconceived. The prevailing field term in Kansas for volcanic ash is silica. Chemically speaking, the ash is composed largely of silica, but this compound is not present as free silica, but in the form of silicates. The term feldspar has also been erroneously applied to the Kansas deposits.

Besides the Kansas deposits there are other extensive beds in Great Plains states—Oklahoma, eastern Colorado, Nebraska, South Dakota and western Iowa—also in the Rocky Mountain states of western Colorado, Montana and Idaho, and in Alaska.

This Kansas report describes the geological formations and their characteristics and origins in detail, by counties. Prospecting for deposits and the mining are also described. Strip mining, or quarrying, is the method universally used—generally small, crude operations. The lumps are broken up in mills of various types, and the product dried and bagged for shipment.

The material is used for much the same purposes as diatomaceous earth, tripoli, etc.; these latter differ chemically from volcanic ash in being practically pure silica. Of the most interest to ROCK PRODUCTS readers is its use as a puzzolana with cement or lime. Its possibilities in this field are hardly explored, although in Europe similar material has been made use of in mortars and concrete for centuries. The report gives considerable data on the use of a similar material—tufa—in making the cement in which the Los Angeles aqueduct was constructed.

The disadvantages of a true puzzolan cement are stated to be: It has less resistance to wear and it sets much more slowly than portland cement. It is stated that volcanic ash can be produced at a cost much less than the cost of portland cement, hence its use as an ingredient in portland cement would not increase its cost and might give it desirable properties, at least for special purposes.

Unslakable Residue in Quicklime

HYDRATED LIME is produced from quicklime by treating quicklime with water in one of several different methods. The hydrate produced is usually in a very fine state of subdivision. However, to insure a uniformly fine product it is common practice to separate the fine material from the coarse by a process of air separation. Occasionally it is found that an undue amount of coarse residue is obtained. When the amount is large it represents a considerable loss to the producer of the lime, and it is consequently desirable to reduce the amount of residue to a minimum.

As it was considered of general interest and value to lime producers, the bureau has investigated the nature of unslakable residues. A sample of quicklime known to give considerable residue and a sample of the stone from which the quicklime was made were obtained. A weighed amount of the quicklime was added to a slight excess of water, stirred until slaking was complete, and then washed by decantation until the water ran clear. This process produced a residue which was dried in an oven at 110 deg. C. and then weighed. It was found that the method gave about 5% residue in the form of hard, gritty lumps, the largest of which were approximately ⅛-in. in diameter. This was ground in a mortar until it passed a No. 200 sieve. It was then analyzed by the method outlined in Bureau of Standards Circular No. 204.

Samples of the stone and of the quicklime were also analyzed by the same methods. SO_3 determinations were made on all three materials by the methods given in Bureau of Standards Circular No. 33. The following results were obtained. They have been calculated to the nonvolatile basis.

Determination	Stone	Quicklime	Residue
SiO_2	0.97	1.00	3.08
R_2O_3	.25	.36	.79
CaO	98.20	97.80	80.90
MgO	.45	.53	15.45
SO_3	None	Trace	Trace

It is evident that the silica is somewhat concentrated in the residue. It is also evident that the greater part of the MgO from the stone has concentrated in the residue.

From the limited data it is impossible to draw any generalizations. It is hoped that future work on this subject may result in some conclusions which will be helpful in eliminating this undesirable waste in hydrated lime production.—*Technical News Bulletin* of the U. S. Bureau of Standards.

Exploitation of High-Silica Rocks*

Varieties and Uses of Rocks Containing 95% or More of Silica (SiO_2)

By Prof. P. G. H. Boswell, D. Sc., M. Inst. M. M., etc.
Hon. Member Institute of Quarrying

OF THE CHEMICAL SUBSTANCES which enter into the composition of rocks, none is more abundant in the earth's crust than the oxide of silicon (SiO_2), termed "silica," of which the well-known mineral quartz is the commonest free manifestation. But although silica constitutes over 59% by weight of the earth's crust, only part of it exists in the free state, for, in combination with lime, magnesia, alumina, iron, etc., it forms numerous other minerals. Nevertheless, "free" silica in the anhydrous form (as the minerals quartz, chalcedony, flint, chert, etc.) and hydrated (as opal, geyserite, diatomite, etc.) are extremely plentiful. Quartz-grains may be associated loosely, forming sand, or cemented together to form sandstone, ganister, quartzite, quartz-schist and other rocks.

On account of the special physical properties (to be referred to subsequently) possessed by silica, the rocks which contain a high percentage (95% or more) have a special value commercially. They are put to a number of uses in the metallurgical, glass-making, soapmaking and other industries.

In this paper I propose to deal only with certain rocks consisting largely of pure silica (the "high-silica" rocks). Even restricting the subject in this way, an enormous mass of data would still remain to be summarized. My object must therefore be to treat broadly the characters, chemical composition, deleterious impurities, uses and sources of such materials, and to give references to published information for the benefit of those who wish to pursue the matter further.

The outstanding physical properties of silica which render it economically valuable are (a) hardness and absence of cleavage, and (b) refractoriness to heat. The hardness is greater than that of ordinary steel, and the absence of cleavage (the property of easy splitting, such as is shown by mica) prevents the mineral breaking down readily when used as an abrasive. The refractoriness to heat is the result of the relatively high melting point, which is about 1713 deg. C. Small quantities of impurities, however, reduce this melting point appreciably.

Siliceous Rocks

When siliceous rocks are used in glass-making, soapmaking (other than abrasive soaps) and similar processes, they are made to combine with alkalies (soda and potash) and with lime. The physical properties are then of less importance than the chemical purity, which must be assured, but the grain-size also is important, for fine dusty material is blown into the furnace flues, with consequent loss of material and adds an extra cost of cleaning flues.

Before passing to the special requirements of particular industries, the various high-silica minerals may be enumerated.

Quartz

Quartz consists of pure silica, when free from dirt and inclusions of other minerals. It exists in two different modifications, varying in crystal form and symmetry: α-quartz, which crystallizes below 575 deg. C., and β-quartz, which crystallizes above 757 deg. C. and below 870 deg. C. The quartz of sands, sandstones and most rocks probably consists mainly of β-quartz, and is yielded by the disintegration on weathering of such rocks as granite, in which it was originally formed. Vein-quartz, well known for its good six-sided crystal form, and so often seen as ornaments, is usually the α variety; it may be colorless (rock crystal), yellow or brown (cairngorm, carnelian), pink (rose quartz), red (jasper), purple (amethyst), green (chrysophase), white or smoky. Aaron's breastplate contained also other forms. In polished spheres of rock crystal, members of the Institute may see in silica their rosy futures. Vein-quartz occurs in mineral veins, often associated with the ores of metals.

Tridymite (of which there are α and β forms), and cristobalite (also α and β forms), occur but rarely in nature and from the point of view of quarrying have but an academic interest. To the metallurgist they are important, for they are the forms of silica to which quartz is changed at high temperatures.

Chalcedony (in its less pure state known as chert and flint) consists of a very fine grained aggregate of silica crystals (and possibly an amorphous form) only visible as individuals under the microscope. In hand specimens it is thus apparently homogeneous. The purer forms are milky-white, bluish or gray, and are translucent.

Opal consists of silica combined with water. As a gemstone it is well known, but is not quarried in Britain.

Tripoli Powder

This consists of the opaline siliceous "skeletons" or tiny organisms known as diatoms, belonging to the plant world. These are exceedingly small (indeed, they are often used for testing the efficiency of a microscope), and on account of this small size, have a gentle abrasive action—they do not score deeply. Diatomite is therefore used for polishing powders, and since the skeletons are open and cellular for insulation, filtration, and as an absorbent (e.g., of nitroglycerine, when the mixture is known as dynamite).

Siliceous sinter (geyserite) may be loosely aggregated or compacted into hard masses. It is a finely divided form of silica deposited from solution, often in the neighborhood of hot springs. It consists of tiny grains of opaline and chalcedy-like silica, which, on account of their small size, render the material relatively soft to the feel. The material forms, however, an effective abrasive for delicate work.

A rather similar finely divided silt of quartz grains is sometimes formed as deposits resulting from the natural solution of the lime from somewhat siliceous limestones.

The more important rocks which contain a high percentage of silica are:

Quartzose Sands

These are sands in which the grains of quartz are loose and uncompacted, and vary in size from 2 mm. (about 1/12 in.) to 0.1 mm. (1/250 in.) or rather less. The impurities in such sands may consist of other minerals (feldspar, mica, etc.) or may be present as coatings to the sand grains (clay, lime, iron oxides, etc.).

Sandstones, which are sands cemented together in all degrees of compactness, by silica itself (when the purest varieties are produced), calcium carbonate (lime), iron oxides, carbonaceous matter, clay, and, more rarely, other substances. When the bonding material reaches about 10% these rocks can no longer be considered of the high-silica type.

Ganister is a rock of this type with certain special physical characters, in consequence of which (combined with its purity as a silica rock) it is of special value for the making of furnace and cupola linings, silica bricks and so forth.

Quartzites are highly siliceous sandstones which have suffered recrystallization, as a result of which the bond is indistinguishable from the original grains, the whole consisting of a mosaic of interlocking quartz grains.

*Abstract of a paper read at the annual conference of the Institute of Quarrying.

Such rocks are therefore very hard and resistant to weathering.

Quartz-schists—Like quartzites, these are also "metamorphic" rocks. They consisted originally of sandstones, usually less pure than those from which quartzite was formed, which have been recrystallized and the grains rolled out under pressure so that the rock is markedly fisile. The lens-shaped quartz grains are frequently accompanied by wisps of mica.

Chemical Analyses

The commercial value of the high silica rocks is entirely dependent on their maintaining a certain standard of purity. Apart from the high percentage of silica, industrial processes demand the absence of certain impurities, or, at any rate, their presence in but very small quantity. But, as one man's meat is another man's poison, the constituents deleterious in the case of one industrial process may be harmless in another. In the following notes I have tried to indicate the forbidden impurities in each industrial application mentioned. Impurities not mentioned specifically may be regarded as harmless, provided the silica content is high.

Silica Ware

Fused silica ware is becoming of increased importance. Long used in chemical and medical work, it is now being introduced into the home on account of its strength (it is not so liable to come to pieces in the hand!), and its resistance to sudden changes of temperature. It is manufactured from aggregates of pure transparent crystals of quartz, free from bubbles of gas and liquid, or from other impurities. The required analysis should show as closely as possible 100% silica.

Glass Manufacture

According to the types of glass made, the requirements vary. For optical glass, very pure materials are necessary, and for crystal ware (table glass), almost as pure. For lighting glass, plate-glass, chemical ware, etc., the standard demanded is rather less high. For window-glass, white bottle ware, etc., less still, and for common bottles a moderate quantity of impurities is permissible. Iron, on account of the coloration it produces, is the inadmissible impurity for good glass. In all cases, however, the size of grain is important, hence well-graded sands usually consist of over 90% of grains of diameter from 1/10 to ½ mm. (1/250 to 1/50 in.). Incoherent deposits are therefore generally used, but soft sandstones are sometimes crushed, screened and washed. The washing removes dust, fine grains and impurities. The prices obtained for the product make the crushing of hard rocks too expensive a project. Vein-quartz seems to possess physical properties which render its use undesirable.

Metallurgical Industries

Large quantities of high-silica materials are used in the manufacture of steel and in the smelting of iron, copper and other metals, for the lining of furnaces, cupolas, etc. They are also used in the foundries as constituents of molding sands. The essential requirement of such material is their high resistance to heat, hence pure quartz sands, sandstones, ganisters, quartzites and, occasionally, quartz-schist are used. Such "fluxes" as the alkalies (soda and potash) and the alkaline earths (lime and magnesia), if present at all, should constitute only a minute proportion of the whole. If the materials are to be used in furnaces under reducing conditions only a low content of iron oxide is permissible.

Most molding sands are not high-silica sands, but possess a natural clayey and ferruginous bond. These varieties are therefore not considered here, but high-silica sands are also utilized to some extent in western Europe, and to a very great extent in North America. When the silica content of such sands (or soft sandstones, for these are often crushed for the purpose, the dust being removed) is 98% or 99%, little room is left for the deleterious impurities mentioned above, particularly as certain quantities of alumina and iron, which are not deleterious, are usually present. These high-silica sands are then bonded with fire clay or some artificial material like sulphite lees. The grading is important, for very coarse material is undesirable and silty matter chokes the pore space of the mold, and therefore should not be present.

High Silica Sands

Similar high-silica sands, with little or no lime or alkalies, are also used for fettling (i.e., bedding) the hearths of furnaces in which acid steel is prepared, or in which copper is smelted.

Crushed ganister and quartzite are employed in the manufacture of silica bricks (when they are bonded with about 3% of milk of lime). The physical and chemical properties requisite in these materials have been so often dealt with in publications, and the literature is so extensive, that it is unnecessary for me to consider the matter in further detail here.

Finally, these same rocks are used for making into a paste (with highly refractory fire clays) with which to line cupolas, stopper nozzles, etc., for metal manufacture.

Abrasives

One of the most important commercial applications of silica is that depending on its hardness and toughness, and absence of cleavage. In various directions large quantities of sand, crushed sandstones, quartzites and vein-quartz are annually consumed for this purpose. Highly quartzose sands are used directly for sandblast purposes in the etching of glass and the cleaning (or fettling) of steel and other metal castings. For this purpose the sand grains should be coarse and tough—that is, there should be little feldspar, but not necessarily highly angular, although at first sight this might appear a desideratum. Exceptionally pure siliceous sands are required in the United States (at Niagara) for the manufacture of carborundum, now widely used as an abrasive and refractory. Long mounds, consisting of a mixture of sand and petroleum coke, are subjected to the action of powerful electric currents, when silicon carbide or carborundum is formed in the cores of the mounds. Carborundum is at present imported into the British islands.

Large quantities of sandstones from North Wales are crushed and ground to provide the fine angular silica which is the foundation of such scouring soaps as "Vim" and "Monkey" brands. For this purpose, not only a high-silica content but freedom from iron oxide is desirable, so that whiteness is assured.

Polishing Powders

Of similar character are the bases of numerous polishing powders for scouring metals, etc. The finest of these utilize diatomaceous earth. Others are prepared from vein-quartz, obtained in North Wales and the Isle of Man, the whiteness of which is an asset.

In bulk, sandstones like the coal measure sandstones of Kenton, in Northumberland, or the millstone grit of Yorkshire, are used for making grindstones and millstones. The bedded cherts of North Wales and Derbyshire and the similar "buhrstones" from France, Belgium and Germany, are used for the bottoms and drags of pan-mills for the grinding of rocks or minerals in the preparation of such materials as pottery bodies and glazes, silica paints, and so forth. Hardness and freedom from iron are prerequisites; the grinding away of the slabs should add only pure silica to the mixture being ground. Rounded shore-flints from the south coast of England and from Dieppe are similarly used in ball mills and are themselves ground after being calcined, as a constituent of pottery glazes. Their use for the manufacture of flint-glass has now been abandoned, although the name is retained for glass of good quality and luster. Similarly, sandpaper is not now made directly from sand, but from powdered glass.

Absorbents, Etc.

A minor industrial application of siliceous rocks is their use as absorbents. The utilization of diatomite in this way has already been referred to above. Crushed and screened vein-quartz and quartzite have been similarly used in acid manufacture, etc. Such materials as artificial silica-gel, however, with its relatively huge surface area, are bound to displace raw materials.

Of the large number of sundry purposes to which silica is put, the use of vein-quartz screened to ½ in. or ¾ in. for stucco work may be mentioned. During the building boom, both vein-quartz and calcite have found a ready market and old mine tips have been exploited. Thus "waste product" has become of value at a time when there was a poor market for the accompanying ores of lead and zinc.

Scientific Merchandising of Concrete Aggregates

A Comprehensive Discussion of Methods of Selling Aggregates Through Comparisons of Whole Construction Costs

By Stanley M. Hands
General Manager, River Products Co., Iowa City, Iowa

SCIENTIFIC MERCHANDISING of concrete aggregate is a selling method which teaches the use of aggregates with various characteristics, and which utilizes their effect upon concrete and the whole construction costs as a basis for determining their value. It assumes as a fact that good concrete can be made from aggregates showing a wide range of sizes, gradation, and other characteristics, and are therefore competitive materials. Their value is relative.

Gradation is the chief of the characteristics. Various combinations of sizes produce gradations requiring various amounts of water to produce the same consistency or slump. Since the amount of water determines the unit stress for concrete with a fixed cement content, it follows that the gradation of the aggregate affects the amount of cement for a given strength. That is, a well-graded aggregate will require less water for a given slump, and therefore give a higher unit strength for the same cement or the same unit strength in less time with the same cement.

The Criteria of Value of Aggregates

The unit strength of the concrete and the time required to get that strength are the criteria of the value of the concrete aggregate. It is known that the strength of concrete can be predetermined both as to amount and as to time. The definiteness that follows from these facts permits of time schedules and definite control in other departments of engineering and construction. The economies realized by this positive control should be enjoyed by the producer of concrete aggregate if, and only if, that aggregate lends itself to these economies. His reward for preparing the aggregate should be participation in the additional profits that come to contractors who are adopting the principles of controlled concrete.

There are but a few sets of specifications that will permit of concrete practices based on the use of aggregates as determined by their individual characteristics. The general practice is to use aggregates as if all of them had the same characteristics. Arbitrary proportions for aggregates result in different cement yields, strengths, and setting periods. These uncertain factors lend themselves to that long list of unknown elements which increase the costs of construction.

Such specifications are an aid in eliminating the bad competition that has sprung up under them, since the vague and uncertain results of practices that have been encouraged by these specifications accentuate the positive results from controlled concrete practice. Contractors need not be reminded of the value of scheduling construction elements. They know what it would mean to their costs. The good aggregate salesman will show that time schedules can be used and that his material has the proper characteristics for the best schedule. Where this cannot be done there are generally other avenues of approach to the greater economy of aggregates with known characteristics.

If concrete materials are to be mixed on the straight proportion basis, by weight or by volume, without any consideration being given to the screen analysis, the aggregate salesman may have a tough job cut out for him. He must pioneer and use promotional agencies. More will be said about this later. However, there may be other things that will interest the prospective buyer.

A Case of Knowing Your Own and Your Competitors' Material

When the straight proportion of materials is used the strength of concrete and the yield of cement for a given mixture will vary with the gradation of the aggregate. A well graded aggregate will require less water for the required workability and will result in a greater strength and volume of concrete. These things are inherent in the material. If the salesman knows the amount or the extent to which any of the competitive materials affect the costs he can make comparisons to determine the value of each of the materials offered to the buyer and

Editor's Note

***THE EDITORIAL STAFF** article in "Rock Products," July 7 issue, on "Scientific Merchandising of Crushed Stone Concrete Aggregate," aroused so much interest that the editor asked Stanley M. Hands, whose work was referred to, to write his own explanation. The accompanying contribution is the result. We urge every producer of concrete aggregates, not merely to read it, but to study it. It will help every producer to make the most of his particular material.*
—The Editor.

Medical buildings at the University of Iowa, with the General Hospital at the left and the Medical Laboratory at the right. The laboratory was constructed first and the materials were proportioned by weight, while in the hospital an inundator was used for measuring

thereby determine the amount that he may expect for his own materials. We are selling material every day in this way. At the same time, we are preaching the advantages of positive control.

Sales talk is made to fit the immediate case and is of such a kind that promotional work is done with each sale. The effect of a well graded aggregate on any of the elements of building costs, whether they be the time element, strength element, or cement yield element, is more than is the effect by a poorly graded aggregate on these elements. It must be shown that the best graded aggregate controls the price of all other aggregates.

The producer's problem is to teach the market to appreciate the utility of his product. The best way to begin is with a salesman who knows the product. His work is to educate the market. The successful salesman must know more about his aggregate than anyone upon whom he is to call. It is no reflection upon the intelligence of a customer that the salesman should be able to teach the utility of goods which are to be bought and sold. The modern salesman must be a specialist, especially in building products. Good selling of materials lends itself to the low cost of construction.

Dealing with the "Understanding Buyer"

Architects and engineers design on a basis of a safe unit strength in the materials which go into construction. This unit strength is found from experience to be such an amount as will protect the building against failure. Its origin is found in the mass of variable figures taken from tests of concrete, which, by the very nature of it's being, have varied over wide ranges. The designer must use that unit strength which he knows from experience will be produced under past practices. He is not unmindful of the effect that higher unit strengths would have upon the costs of construction. Just as soon as everyone involved in making that concrete will assume his share of the responsibility so will the designer be willing to make his calculations and deductions by using this higher unit stress.

A salesman must assume that the architect and engineer know their business. Most of them are inclined to listen and pay attention to anyone who can talk intelligently about things that affect their business. They are students by nature of their training and experience. They cannot specialize. Concrete to them must be just construction material. If it meets the strength requirements of their design they are satisfied. Seldom do they specify the manner in which the contractor is to get that strength. So work on their student nature and get them interested in the methods of getting higher unit strengths in the future.

Utilize Powerful Educational Agencies

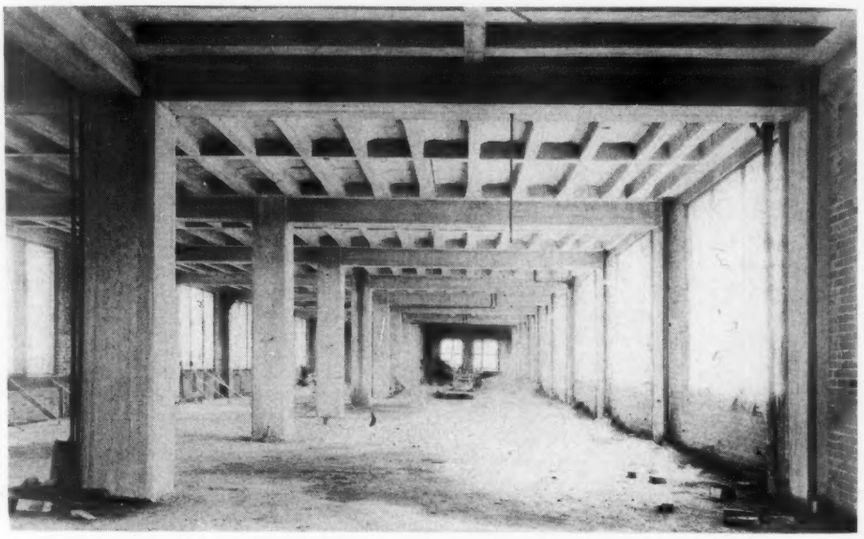
It is evident that if scientific merchandising is to be practiced, concrete practices must be revolutionized in some, if not all, localities. This would be a big undertaking for the small producer alone. Fortunately there are powerful educational and promotional agencies that can be brought into action. Foremost among these is the Portland Cement Association, with offices all over the country and men in the field in most localities. This organization is constantly preaching the doctrine of better concrete and economy in the use of cement. A careful study of their bulletins is helpful in getting a knowledge of concrete. Some of the finest developments in concrete and concrete tendencies are discussed by the membership of the American Concrete Institute. We recommend this organization to every man who wants to keep up on concrete. There are other sources of information such as engineering and architectural societies. Private research is being carried on continuously. The trade journals call our attention to the practical results of these experiments. Last, but not least, we have the investigators of the National Crushed Stone Association and the National Sand and Gravel Association. These promotional agencies are trying to break down the door behind which hides "Old Methods" and "Obsolete Equipment," two old misers who are hoarding the profits of the contractor and material man.

All of which is promotional and will take time.

Work on the Contractor

After a contract is let, the man to talk to is the contractor. His interests are to lower the costs. He wants to buy things for less than they are worth. That is the thing to do. Show him that some materials are worth more, but that you will sell them for less than they are worth. The sale price which is based on the value of the material will vary for each material depending upon its effect upon the total cost of construction.

We estimate what our material is worth on every job. Our price varies with the manner in which the contractor can handle his job problem. Each job has its own problems. The medical laboratory at the University of Iowa was awarded to a contractor who assumed the responsibility for producing a finished concrete that would require no finished plastering. The prices bid for this building were in excess of the available money. If the plaster were cut out the work could be done within the estimate. When questioned about doing such things, J. M. Fisk, superintendent of grounds and buildings, recommended concrete control as assurance of a good looking job plus other desirable results. The board of education accepted the recommendation and awarded the contract. The successful bidder would not have been the low bidder if the plastering had not been struck out. (The concrete produced on this job was photographed and the pictures shown in the July 7 issue of Rock Products.) We do not know that the contractor was told that he would be assured of success if he bought our materials, but we do know that the sympathetic support given to us by the university authorities had much to do with our getting the contract for the stone, and at a figure considerably above the price of other materials.



Hospital interior. Less water and well-graded sand and stone, measured by weight, gave greater strength, increased the cement yield and provided concrete pleasing in appearance. The cement brick in the walls were made with sand and stone dust

One Success Leads to More Business

This support was the natural thing to come out of the experience that Mr. Fisk had had with two other buildings. Mr. Fisk had previously erected the chemistry building with his own men and equipment. The concrete produced was above the required strength and did not need any plaster to improve the looks. This concrete was made from our material and the only requirement was that it be well graded and uniform from

day to day during the course of the work.

Subsequently the building of the university high school was let by contract. The contractor bought a cheaper material. The producer of this material recently said that that contractor wanted only a low price. Troubles began with the first batch of concrete. Excessive amounts of water were required to make the concrete workable. This excessive water lowered the strength below the requirements. Additional cement was required to meet the increased demand for water until the cost of the concrete mounted up to a figure that would more than pay the difference between the price of our material and the price of the material used. Inability of the producer to make a graded aggregate resulted in that producer having to buy our material at a loss to himself but a gain to the contractor. The gain to the contractor was in the cement yield and in the labor saved in placing and puddling. This same producer is now making a graded aggregate which he sells at higher prices and in markets where we do not compete and in which he has developed an appreciation of his product that precludes any possibility of anyone ever forcing upon him the same kind of experience that he did not enjoy on the above job.

The Tapager Construction Co., Albert Lea, Minn., had a very fine opportunity to realize the advantage of using well graded aggregate in the construction of the American Legion building at Iowa City. This work was inspected by B. J. Lambert, professor of civil engineering at the University of Iowa.

The building is being erected on the property line at the side of the approach to the viaduct over the Rock Island railroad tracks. This approach is a dirt fill, the slope of which extends well out into the property. The design called for a wall about 20 ft. high to serve as a foundation wall and a retaining wall. The excavations for this wall so weakened the bank that cracks began to appear in the ground along the sidewalk and just back of the pavement curb. Everything indicated that the bank would slip off into the excavation and take the pavement with it. Something had to be done at once.

Professor Lambert suggested that designed concrete could be made that would give sufficient strength in a week to permit backfilling. This was done and the forms were removed thereby saving considerable lumber for the contractor. This could have been done with any material but the thing that was of interest to the contractor and ourselves was that it required nothing more than the regular proportions to get the 2800-lb. concrete in seven days.

Priced to Fit the Job

Therefore our price varies with each job. The job is studied and competitive materials are studied and our price is determined on a comparative basis. Our price is the cheapest because we figure ahead how much we can get for our materials.

In making these determinations begin with a profit to the customer. Competitive prices can be approximated. Estimate the cost of concrete in place by using this price. Work backward to your own material and figure what a contractor could pay for material graded as you are grading yours. Consider more than the costs of handling and transportation. It is often the case that some of these may have to be absorbed.

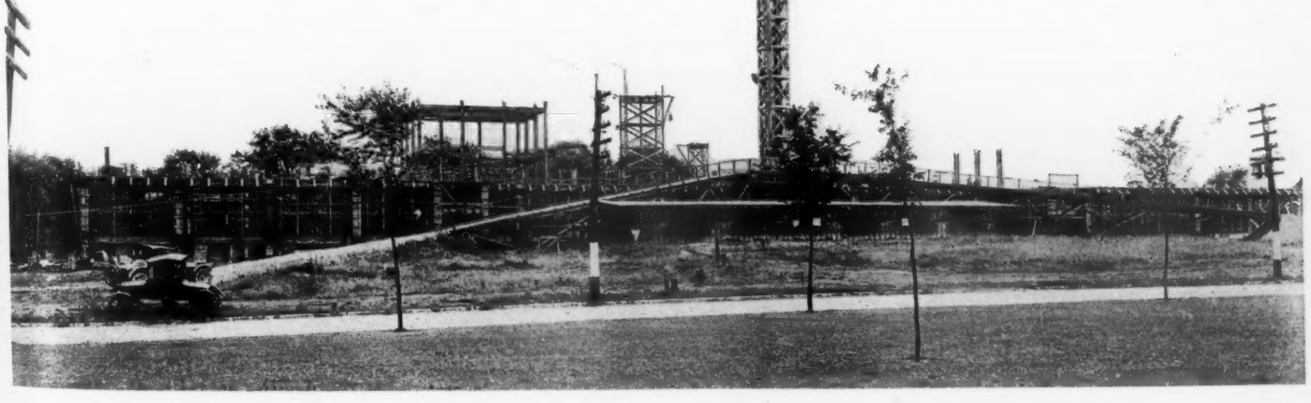
Crushed stone that has been switched about in railway yards and bumped over low joints can not be dug out of the car as easily as round gravel. This may affect the capacity of a crane. Consider a remedy. We know of times where a small crane could handle more material by unloading from the car to the stock pile and reclaiming from the stock pile to the bins than if the material was handled direct from the car to the bins. (Contractors that want to argue this point should just try it first. Note how much bigger the bite of the bucket from the loose pile than from the packed car.)

Figure the price of the aggregate to participate in the saving in labor, lumber and other materials, finance, insurance and other things affected by good concrete. Our price is based upon the value of good concrete and its effect upon the cost of the whole job.

A Specific Example

A typical example of our experience in getting orders is that of the construction of the university heating plant by A. A. Alexander, Des Moines, Iowa. Mr. Alexander is a graduate engineer having been in school with the writer. He has given me a great amount of information as to actual quantities, but since this was confidential information we must pass it up. Mr. Alexander, like other contractors with whom he had to compete, was batching with wheelbarrows or shovels. B. P. Fleming, professor of mechanical engineering at the University of Iowa, had charge of this work. He had designed the heating and power layout, but not the housing structure. His knowledge of concrete was far from being on a par with his knowledge of mechanical devices. Mr. Alexander and Professor Fleming did not have much luck with the concrete on the heating tunnels. The aggregate used was a good sand and a poorly graded gravel. The consistency of the concrete varied and water control was almost impossible. Like sensible men they tried to find some common ground on which to deal. We could not sell the material for this job because the material being used was much cheaper, as measured in cost per ton, and would pass the specifications. The job was finished all right but neither the engineer nor the contractor was satisfied. The concrete showed the proper strength, but the mental strain created by difficulties with the concrete was demoralizing, and there was great relief in the completion of the tunnel.

The experience gained by Mr. Alexander and Professor Fleming on this heating tunnel work, when compared with the easy way in which the medical laboratory progressed, resulted in an agreement to use a batching plant and an inundator. A Blaw-Knox outfit like that on the medical laboratory job was installed for use on the heating plant foundations and building. The architect's specifications for concrete materials were



The concrete handling layout which was designed and its erection supervised as part of the contract for the sale of the crushed stone for concrete aggregate. The bins holding about 12 cu. yd. of stone and 9 cu. yd. of sand are shown at the foot of the tower with the ramps for the trucks leading to them

disregarded. This disregard for the architect's specifications logically followed from the experience on other building jobs on the university campus. It had been domonstrated that better concrete could be made for less cost to the contractor if mixtures were designed and proportioned and with batching plants.

Refinements in Control on the Job Necessary

The aggregate producer will find that the refinements of control necessary to the full utilization of any aggregates is inherent in these plants. The producer's success in guaranteeing cement yield, initial and ultimate strength, is greatly insured by this inherent property of control. We do not mean that a batching plant is fool-proof. It is a device that eliminates a great many of the variations in concrete results. Control of concrete materials and concrete is an essential element in successful aggregate salesmanship.

We suggest that the sales efforts of equipment men, material men, and other promotional agencies be co-ordinated in such a manner that the market is improved for all. We have done this. We have sold an engineering service with our material on several jobs. We have designed the concrete handling plants and selected the equipments to make the kind of concrete we have guaranteed. In another article which is to follow this, we will discuss in detail the application of technical fundamentals to practical construction. We can show the importance of those fundamentals and their bearing upon selling concrete aggregates for high prices.

New Cement Plants in Brazil and Portugal

By Dr. C. R. Platzmann
Consulting Engineer, Hamburg, Germany

THE TENDENCY maintained since the year 1914, to cut out the European and American cement imports, has recently made further progress. Brazil, which thus far was one of the most important foreign markets for European cement, has now also started to free itself from its dependence upon foreign countries by erecting in the state of Sao Paul, in Perus, the first cement plant in Brazil, with a daily output of 1000 bbl., which is to be increased to 1500 bbl. after completion of the contemplated enlargements. According to the publication of the agricultural, industrial and commerce ministry in Rio de Janeiro, the plant is so designed that by the installation of additional units of machinery it may have a later production of 3000 bbl. per day.

The quality of the new cement was tested and found satisfactory by the Technical High School of Sao Paulo, by the Sao Paulo Tramway Co. and by Mackensic College.

The plant operates with the dry process. All machinery is electrically driven with 40 motors all told, which show a capacity of 21,000 h.p.

The raw materials employed consist of limestone and clay, which is hauled to Perus by means of a railway employing two oil-fired locomotives and 40 side-dump cars of 5 tons capacity each.

The limestone is broken at the quarry to 8 cm. (3.15 in.) size and delivered by means of a transporter into a hammer mill (Pennsylvania make), which continues the sizing to 1 cm. (0.39 in.) size; the dust resulting thereby is stored in a bin. The transporter also hauls the clay from railway cars to a roofed storage. From this storage the required quantities of clay, limestone and schist are taken, and after being sufficiently ground drop into a mill feeder, from which they are carried by means of a transporter and elevator to the dryer. The raw material thus dried is delivered to a storage, from which it is controlled by automatic measuring apparatus and delivered to the mills by means of suitable transporting equipment. By means of Fuller-Kinyon pumps the prepared raw mix is delivered up to the storage plant. From here the raw mix is delivered to the rotary kiln; a further kiln is at present under construction. With a diameter of 3 m. (9.8 ft.) the kiln has a length of 50 m. (164 ft.) and a speed of one revolution per 1½ minutes. Burning is done with an oil firing system. The burned clinker is cooled in a cooling chamber and then delivered to the clinker storage by means of an elevator from which the clinker can be taken for grinding. Screw conveyors deliver the cement to the Fuller-Kinyon pumps, which deliver it to the silos or bins, from which the cement can be packed by Bates bagging machines.

Even though the influence which this new plant will have upon the European cement importation into Brazil cannot be very large, due to the great demand for cement, yet one will have to figure on the other hand that other plants will soon follow this one.

Portuguese Plant

The conditions in Portugal are much similar. Before the year 1914 the annual import of cement into Portugal was 40,000 tons, which is explained by the imperfection of the domestic product. There were three plants: (1) Rasca, near Setubel, with an annual production of 10,000 to 14,000 tons; (2) Alhandra, with a production of 5000 to 8000 tons, and (3) Figueira la Fox, which, however, produced primarily hydraulic lime. During the war the import decreased to 10,000 tons and therewith arrived the opportunity for the development of the domestic production. The plant Leiria, started with an annual production of 35,000 tons, was placed in service in 1923. By installing another rotary kiln, the annual production can be increased to 70,000 tons. The plant was erected in Maclira (District Leiria), 5 km. (3.1 mile), from the railway station Martinganca and works a raw material available 1 km. (0.6 mile) away. Since its construction required 7,000,000 brick and 400,000 roofing tile, a brick yard was erected at the same time, which is equipped for a daily output of 15,000 brick and 1000 roofing tile.

The plant is located in such a way that the present capacity of 50,000 tons can be increased to 100,000 tons without requiring changes in the building. The buildings comprise the cement mill, equipment for pulverizing the coal, the cement bins, a barrel factory, a laboratory and an electric-power generating plant. A cable railway delivers the lime-containing raw material to the plant. The raw material is taken from two quarries, of which one delivers marl, originating from the Liassic formation, with 64 to 70% $CaCO_3$ and 28 to 34% clay, whereas limestone with 93 to 96% of $CaCO_3$ content (middle Jura formation) is taken from the other quarry. The raw material from the marl quarry is removed from it by means of a mechanical Kraus cable railway suspended between two wood towers 21 m. (69 ft.) tall. The quarry is blasted with dynamite and the drilling is done with compressed-air hammers. The quarried stone is placed in iron boxes of 2 cu.m. (70.6 cu. ft.) content, which are raised by the crane and emptied into a wooden bin or silo. This is provided with gates in the bottom, through which the cars of the cable railway are filled, which deliver the stone directly to the hammer mills. The material is hauled from the limestone quarry by means of an inclined plane; the cars empty their contents into a bin which feeds the cable railway.

The mill equipment was supplied by S. Polysius, Dessau, Germany. The Diesel engines for generating the electric power came from the Maschinenfabrik Augsburg-Nuernberg, the electrical material from the Sociedade Lusitana de Electricidade A.E.S. According to a report in the Lisbon periodical *Sciencia e Industria*, the cement has the following composition:

Fe_2O	1.26%
Insolubles	0.67%
SiO_2	20.85%
Al_2O_3	9.00%
Fe_2O_3	4.15%
CaO	63.42%
MgO	1.93%
SO_3	1.52%
K_2O and Na_2O	0.30%

The quality of the cement which was tested by the Swiss standards is said to be satisfactory.

Lime Burning Practice Based on European and American Observations

Part X.—Rock Handling at German Lime Plants—Ring Kilns

By Victor J. Azbe
Consulting Engineer, St. Louis, Mo.

IN ORDER to understand the German use of ring-kilns, or ring-oven kilns, something must be said of the method of handling kiln rock. Fig. 53 shows part of the Schlupkothen quarry with the rock crushing and screening plant in the background. Fig. 54 is another view. Steam shovels are used to load the rather large cars; these are then run to an incline elevator. When Fig. 55 was taken, one of the cars was being dumped. Fig. 56 presents the system in a diagrammatic manner.

After the stone was properly prepared and separated into the ring-kiln, gas-kiln, mixed-feed kiln and other sizes, it was brought up from the low part of the preparation plant in ordinary dump carts, but by a rather peculiar system. The carts are run under a continuously traveling chain which pulls them up the rather steep incline. Unfortunately this rather interesting system is not very clearly shown in Fig. 54.

Chains as a medium of conveyance are encountered all through Europe in a variety of forms. In this case the chain lies across the top of the cart. At Hermalles it engaged with the base of the cart. The most interesting, however, is to see a river tugboat pull itself by a chain. All along the Rhine, or Elbe, and other navigable rivers chains lie on the bottom. Boats which have the privilege and the special machinery pull themselves up the river by these chains without the aid of a propellor.

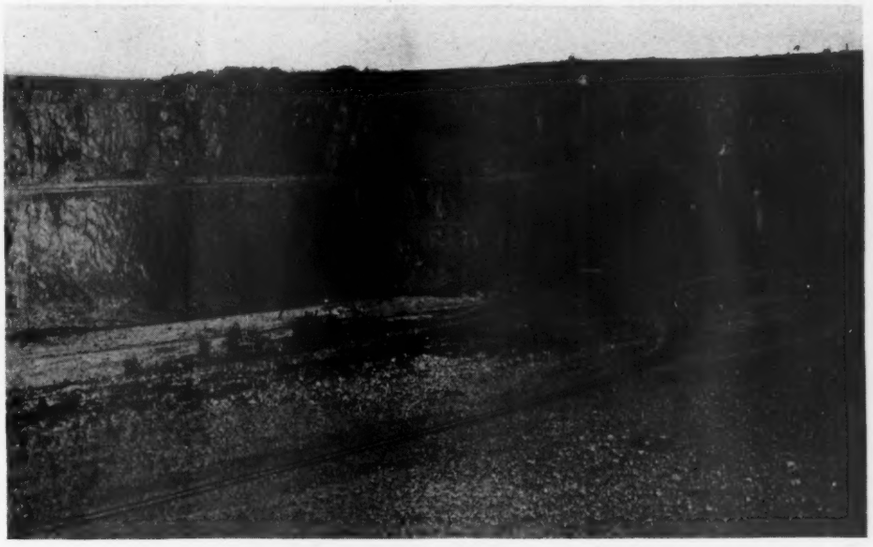


Fig. 53. The Schlupkothen quarry with the crushing plant at the left

The quarry of the Johann Schaefer lime manufacturing concern is located particularly low in reference to the kiln. Figs. 60 and 61 show how the rock used in their ring kilns is brought up by a system too slow to be practicable in any but a small plant. Fig. 62 demonstrates, however, the heights that can be conquered and amounts of stone handled at one operation by this method.

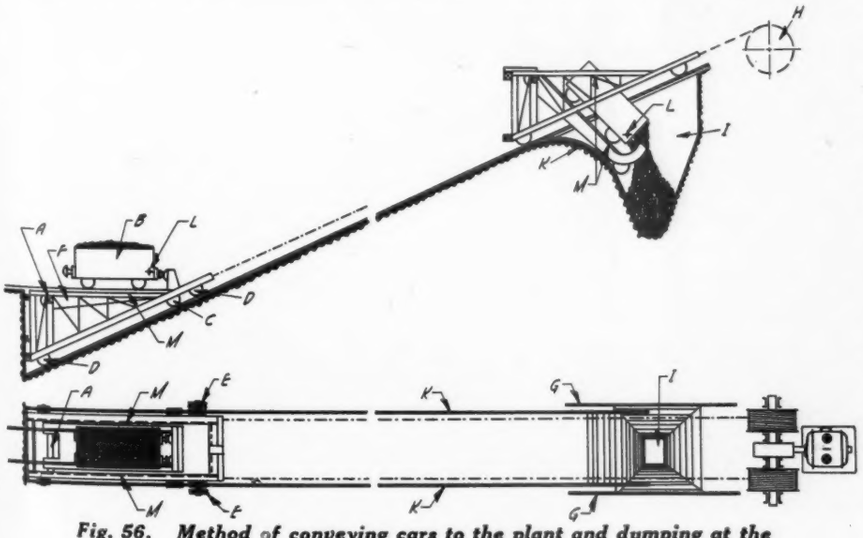


Fig. 56. Method of conveying cars to the plant and dumping at the Schlupkothen works

The Most Generally Used German Lime Kiln—Hoffman or Ring Kiln Type

To the writer's knowledge the ring-kiln for lime burning is not used at all in the United States, and doubtlessly it never will be used. This kiln, however, is used to quite an extent for burning of clayware, and for that purpose it is superior to many other kilns. However, the time used in its study for lime burning is not entirely wasted, since its method demonstrates beautifully the counter-current principle of heat flow so desirable in lime kilns.

The airing kiln is practically a continuous circular tunnel, having many doors and many connections to a high stack. They may be built in a perfect circle or may be elongated or star-shaped, or cross-headed, or any other shape, but the underlying principle is the same—a continuous tunnel about 200 to 300 ft. long, with the two ends joined as shown in Fig. 63. The limestone is placed in by hand, and the lime is withdrawn in the same way. Only the use of large stone is practicable, and even that must be placed with care. In the charge, open spaces are

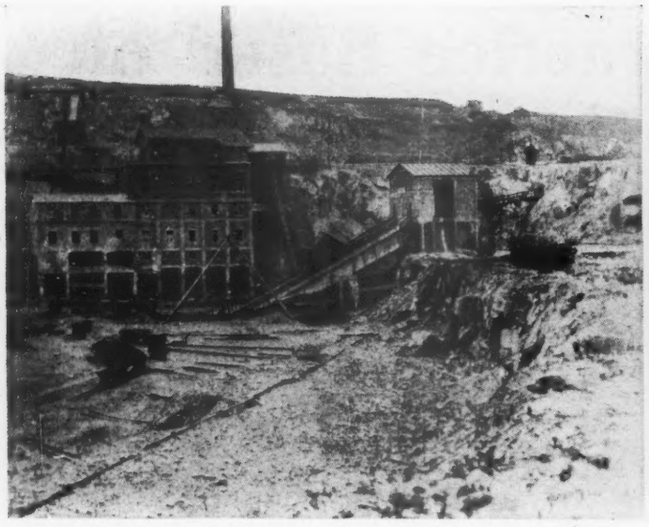


Fig. 55. Closer view of the Schlupkothen crushing plant, showing a car being dumped

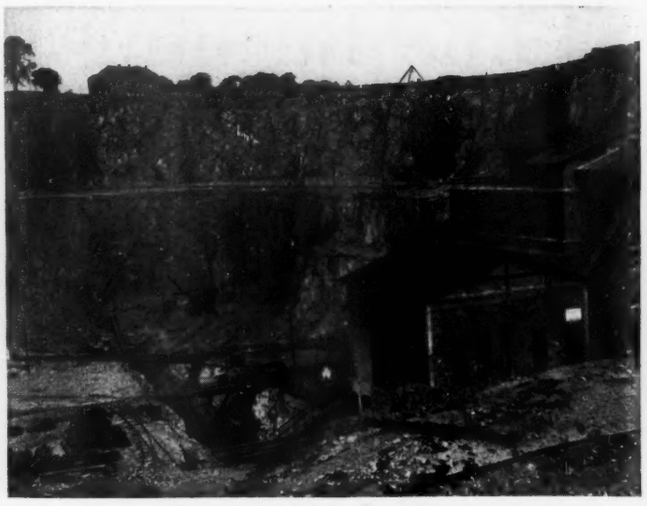


Fig. 57. Looking down into the quarry from the Schlupkothen plant

left into which coal is thrown through openings in the crown, when that particular portion of the kiln is fired.

Figs. 64, 65 and 66 show the external portions of these kilns. Draft is produced by the 225-ft. high stacks overtopping the kilns. Each kiln has its own stack. Induced fan draft can also be employed.

The study of Fig. 63 reveals that the kiln may consist of sixteen sections, defined only by the fact that each of these sections has an opening to the outside and one to the stack, either of which can be closed or opened at will. Assuming the kiln in operation: Sections 10 and 11 are fired by throwing in coal of variable amounts at different points through openings shown in Fig. 67. The air for combustion enters the kiln through open doors in sections 1, 2 and 3, and passes in the direction of the pointed arrows. This air passes through the burned lime in section 4 to 9; on its path it becomes progressively hotter, and the burned lime in these zones equally progressively cooled. In sections 12 to 15, products of combustion and the excess air are cooled off and the stone correspondingly preheated. At sections

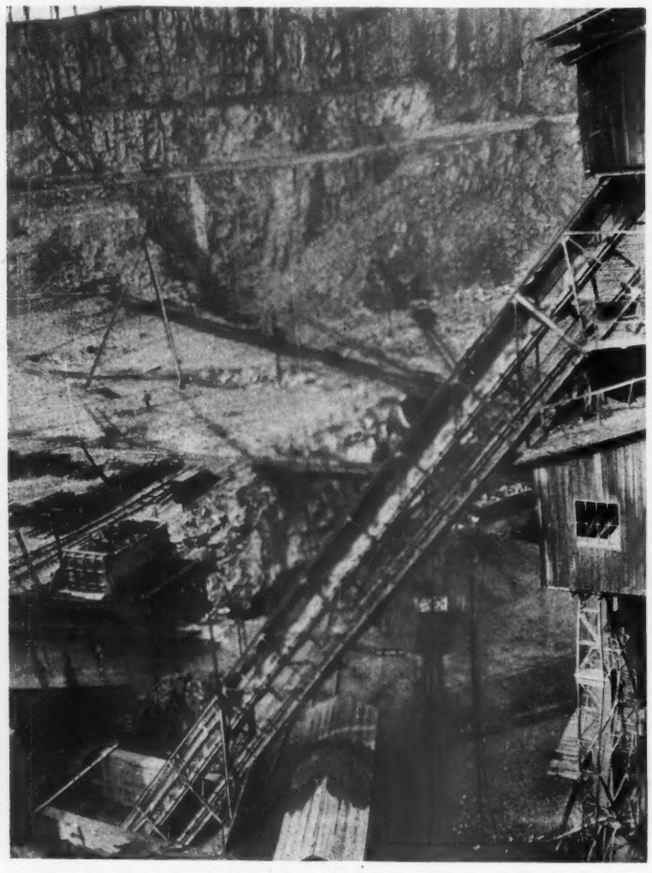


Fig. 54. The inclined elevator to the Schlupkothen crusher, at the left, with a car starting up the slope

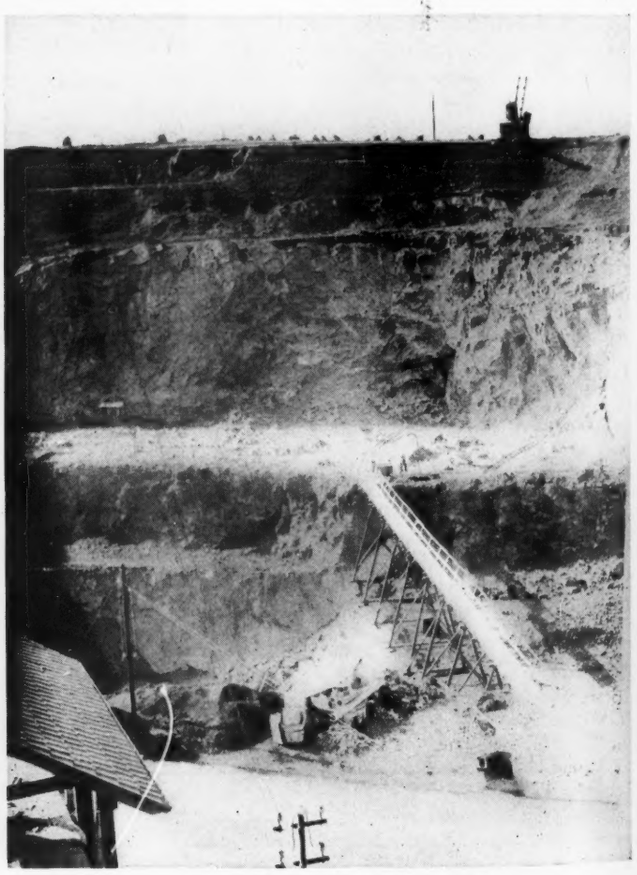


Fig. 59. Typical of the quarries of the German lime manufacturing industry

Fig. 58. Showing quarry face and the type of material handled. Note the European type of dinkey

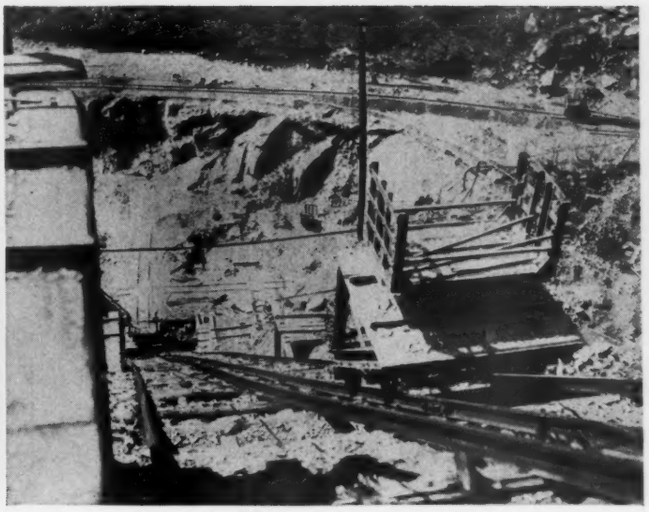


Fig. 60. Method of raising rock from the quarry to the plant at the Johann Schaefer works

14 and 15, stack connections are open and the cooled gases escape to the chimney. To prevent the chimney draft from drawing air from sections 1 and 16, these are sealed off with paper.

The lime is taken out of section 3 and the limestone charged in section 1; section 2 being empty. By the time section 1 is filled, section 3 is empty and section 10 is burned so the firing of section 12 begins. Section 14 has stack connection closed, and section 15 has stack connection opened. Section 1 is sealed off with paper. Workmen begin to take the lime out of section 4, and are charging limestone into section 2, and so the process goes on with the same variations year after year. These kilns need never to be shut down, since the different sections can be repaired as they become exposed.

Out of 16 sections only two or probably two and a half are actually burning lime. The purpose of the balance of the kiln is to heat the air and cool the gas, or, one could also say, cool the lime and heat the stone.

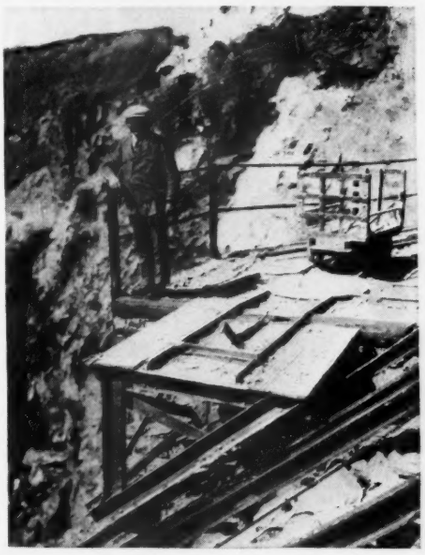


Fig. 61. This car is used for raising the plant at the Johann Schaefer quarry

The various processes that go on in a lime kiln can be observed better in this than in any other type, and the information obtained is most interesting. Note, for example, the very long path the air travels during the process of preheating. Compare this with some vertical kilns, where almost no air enters through the cooler and the lime is drawn cherry red. No wonder such kilns are not efficient. That such a clumsy kiln as these ring kilns can be efficient in spite of the great amount of wall surface exposed, chances for air inleakage, for uneven gas flow, proves the importance of proper air preheating and gas cooling.

The capacity of one of these kilns ranges in the neighborhood of 40 to 60 tons, rather low compared with the area of the land that it covers. Labor requirements are high; some of the men must be skilled, particularly those engaged in charging, since within the piles of limestone as it is charged proper canals have to be built for air or gas to travel and for coal charging. This charging

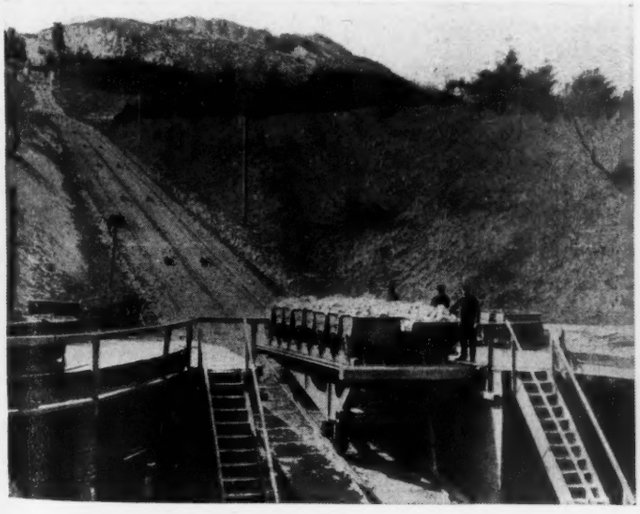


Fig. 62. This shows how high the material can be raised by the inclined railroad method at one German plant. It is good for only small capacities

Fig. 64. General view of the Hoennetal plant of the Rheinisch Westphalischen Kalkwerke illustrating the high stocks used to obtain the necessary draft

must all be by hand, so as to assure that the hot gases will penetrate all portions of the section. The removal of lime is not particularly pleasant, especially in summer, for the lime still is warm and so are the walls, which, due to their thickness, cool off slowly.

The Johann Schaefer plant at Limburg (Fig. 66) had two such ring-kilns and employed 60 men, including the quarry, delivery of stone, charging, firing, emptying, loading, etc. The fuel ratio obtained at this plant was about 4 to 1, with fairly good coal, which for German conditions one would not consider good at all.

At the Hoennetal plant of Rheinisch Westphalischen Kalkwerke (Figs. 64 and 65), in addition to the mixed-fuel kilns described in a previous article, there were also ten of these ring-kilns; and for each kiln of 55 tons capacity they employed at the kiln proper four men for charging, four for discharging, and the equivalent of one-half fireman. This is very much more when compared with the figures already given for their four large mixed-feed kilns, described in this series.

The ring-kiln, however, has the advantage of giving the greatest amount of lump lime, and that in Europe, where hydrators are not used to much of any extent, is important. The appearance of the lime coming out of these kilns does not equal that from a well-operated gas kiln, by far; the surface of all of it is somewhat discolored, and where coal was in contact with the lime the adherent clinker has to be cleaned off.

The operation of these kilns is practically smokeless, but usually the operation uses great amounts of excess air, due to the large size of these kilns, and because of the many openings, to keep this excess air down is difficult. Rudolf Seeger, of the German

Fig. 66. The Johann Schaefer plant at Limberg

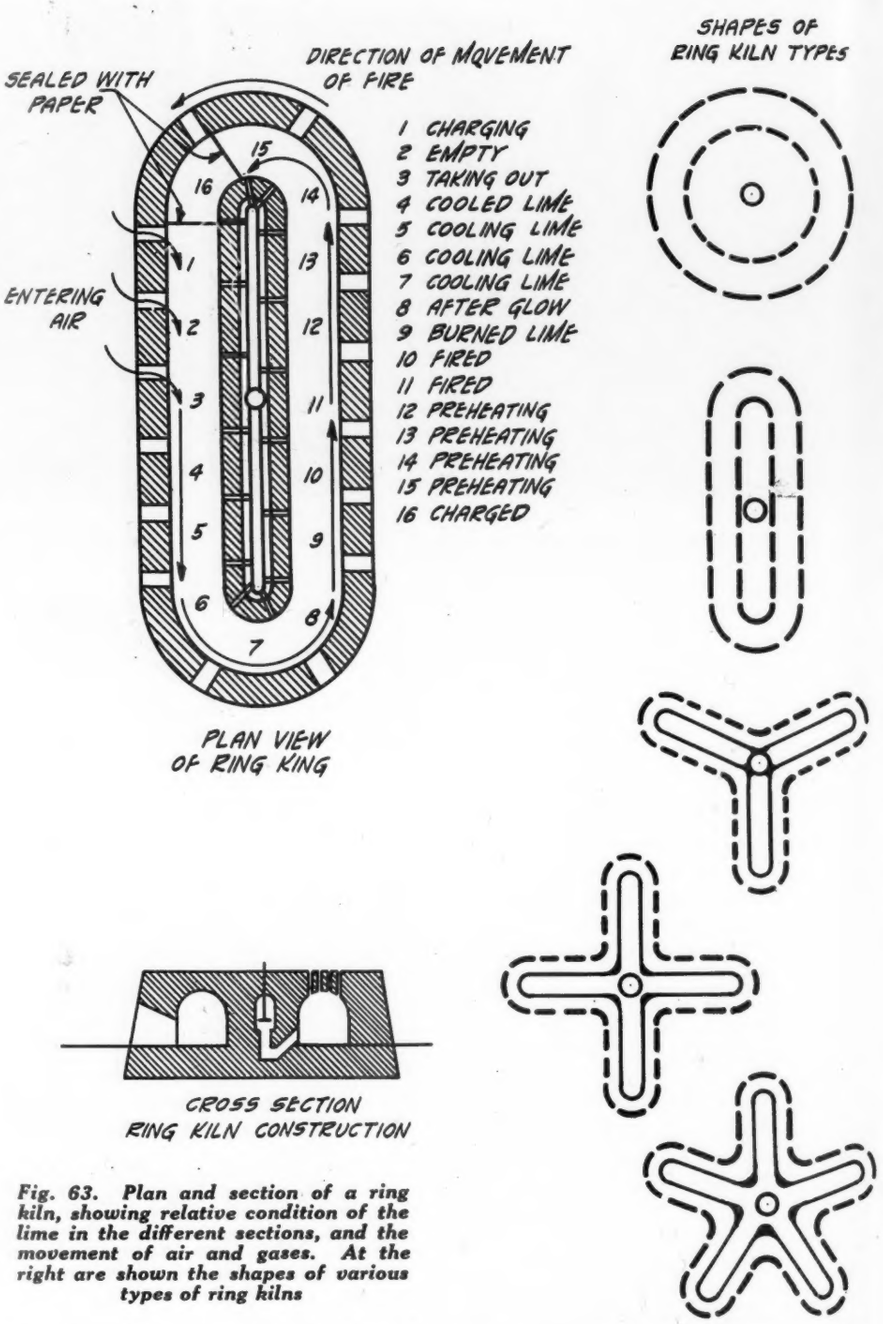


Fig. 63. Plan and section of a ring kiln, showing relative condition of the lime in the different sections, and the movement of air and gases. At the right are shown the shapes of various types of ring kilns

Lime Association, who made a thorough study of these kilns, however, was able to make considerable improvement in their operation.

The director of the German Lime Manufacturers Association very kindly supplied the writer with the following statement, which together with the data above should eliminate the ring-kiln entirely from consideration for American conditions:

Director Urbach's Comments About Ring Kilns

The bulk of the lime throughout Germany is still produced in ring-kilns. A gradual change to shaft kilns is taking place, however, accelerated by the increasingly high wages. The advantages of the ring-kilns are the possibility of obtaining a coarse, lumpy lime (structural lime), and of exercising an influence on the quality of the product during its production. These make the ring-kiln still popular in producing lime for the chemical industries. The greatest disadvantage of the ring-kiln, from the point of view of heat economy, is the large supply of excess air, which cannot be reduced appreciably because of the method of charging the kiln, and the desire to achieve maximum production. This results in a higher loss of free heat than in the shaft kiln. The loss of chemically absorbed heat is almost equal to zero. As the flame is not restricted to one area, as in the shaft kiln, but is allowed to traverse the entire kiln, high heat losses are produced in the masonry. The heat balance of a ring-kiln is, in general, somewhat less favorable than

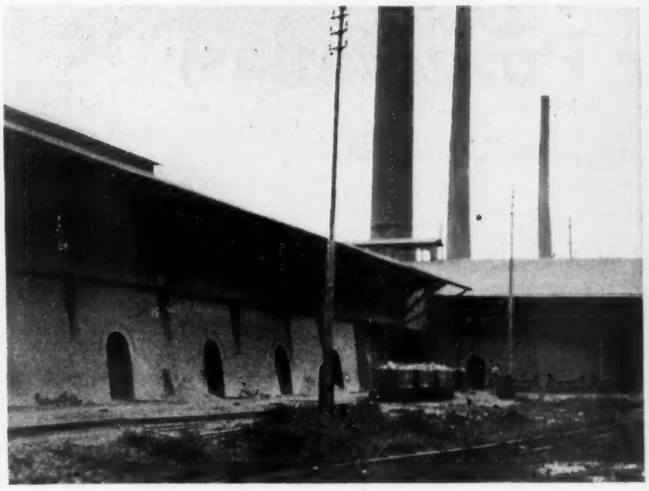


Fig. 65. Kiln buildings at the Hoennetal plant of the Rheinisch Westphalischen Kalkwerke

Fig. 67. Openings on top of a ring kiln through which coal is thrown in firing the kiln

that of a shaft kiln. The average heat balance of a ring-kiln is as follows:

Useful heat in burning lime.....About 40%
Loss of free heat.....About 40%
Loss of chemically absorbed heat.....
.....Almost 0%
Loss by conduction and radiation..Up to 20%

Due to the method of firing, the fuel used to best advantage in a ring-kiln is a high value coal, producing a long flame, showing little tendency for coke formation and leaving little ash. Burning of lime in ring-kilns calls for greater skill of the labor personnel than is the case with shaft kilns. The same is true of the management. In spite of its disadvantage, the ring-kiln has many advocates in Germany today.

(*To be continued*)

Fine Ground Raw Rock Phosphate Replacing Acid Phosphate

THE RUHM PHOSPHATE AND CHEMICAL CO., located on the Mt. Pleasant, Tenn., southern branch of the L. & N. R. R., about 1½ miles from Mt. Pleasant, is producing a new product, Ruhm's non-acidulated phosphate, which, it is claimed, is the best phosphate on the market.

This product closes in speed of results the gap that has long existed between the old raw rock phosphate and the acid or superphosphate, and is found in the ground in its natural state as the partially disintegrated remains of several strata of the Bibgy phosphatic limestone.

It is covered by an overburden of clay and loam, varying in thickness from 1 to 2 ft. to over 18 ft., which is removed by dragline excavators of which there are two with 70-ft. booms.

After this overburden has been removed, the phosphate deposit, varying from 4 to 15 ft. thick, is mined with the same excavators, aided by a specially designed cantilever machine. Pick and shovel work is used to clean up in the cutters between the phosphate boulders of limestone which form the floor of the mine, all being open cut mining.

The entire deposit is dropped into Western 4-yd. dump cars drawn on 3-ft. gage tracks of 65-lb. rail by 25-ton Davenport locomotives. These take the material to a green storage yard capable of holding over 50,000 tons, or it is dumped into a skip hoist, which takes it to the top of a washer feed hopper holding about 16 trams or 1½ hours run of phosphate.

The hopper feeds to sets of crushing rolls, reducing all pieces to maximum size of 3 in. The material here contains on a dry basis 58 to 65% phosphate with 8 to 15% iron and aluminum. It is then dropped into a revolving bottom plate mulcher which gives a preliminary shredding where the clay balls are completely macerated to permit emulsification in the later stages.

Then it passes into the main washer cylinder half full of water, where the very fine phosphate particles and the clay and other impurities are carried off with the water; the lumps above ¼ in. are discharged to perforated rinsing screens dumping on to moving belts where men and boys pick it over. The washed product accumulates in a final bin where it sinks to the bottom. The waste that is washed off in the process is recovered in settling ponds.

The washer capacity is 275 tons per day of 10 hours; a grinding capacity of 300 tons per day of 23 hours and a drying volume of 500 tons. This can be loaded at a rate of 45 to 50 tons per hour. Large blacksmith, carpenter and machine shops, a 50,000-gallon water tank on a steel tower, office and commissary and round houses and accessory buildings complete the installation.

Plant Construction

The plant is of modern design and permanent steel and concrete construction, leading in the matter of uniformity of product and complete saving of all phosphate values from the deposit with a minimum of impurities. It is the "oldest and largest producer of finely ground, non-acidulated phosphate for direct application in America."

The village of homes for the operatives and employes consists of 16 houses for white and 35 for colored, with well conducted schools and churches.

The officers and directors of the company are: John Ruhm, Jr., president and treasurer; H. D. Ruhm and R. D. Hoover, vice-presidents; F. K. Hoover and Earl Hoover, directors; W. S. Mabee, manager of operations, and S. L. Jones, secretary. The main office is at Mt. Pleasant, with offices at 1407 Railway Exchange, Chicago. — *Nashville* (Tenn.) *Banner.*

Austrian Magnesite Industry

DURING 1927, Austria exported 97,000 metric tons of burnt magnesite which contributed in excess of $4,000,000 to the nation's trade. Prior to the world war, Austria enjoyed a near monopoly of the world's supply for dead burnt magnesite, in 1913 having exported 123,000 metric tons. During the war, however, some of the nations either introduced substitutes or found workable deposits within their own territories.

The most important Austrian deposits are located to the southwest of Vienna in the states of Styria and Carinthia. Most of the deposits are massive and crystalline and are close enough to the surface to permit their being worked by open cuts.

There are at present six magnesite companies incorporated in Austria, one of which is largely controlled by American interests. Of the five Austrian companies, three are corporations with a total capitalization of over $3,000,000, while the other two are private undertakings. The whole Austrian magnesite industry employs approximately 2500 workers.

Pozzolanas (or Puzzolanas)*

A Largely Neglected Industry in the United States

THE history of building shows that certain types of lime mortar, more particularly those used by the Romans in some of their large public works, have proved to possess extraordinary hardness and durability, as well as a degree of impermeability to water that compares well with that of first-class portland cement mortar. In many cases the strength and adhesive power of the mortar is such that, when a piece is broken across, the particles of aggregate will themselves fracture rather than part from the mortar. On the other hand, other types of lime mortar, contemporary with these, and which have had at least an equal opportunity of hardening, are in a weak, friable condition, and fall to dust when the building is disturbed. In general, the difference is most striking in mortars in the interior of thick walls, e.g., in the rough rubble construction frequently used to fill piers and walls in ancient buildings faced with ashlar or brick.

The hasty conclusion is sometimes drawn from such observations that the ancient builders possessed some secret for the making of lime mortar which has been lost, so that now only portland and other modern artificial cements can vie with the old Roman lime mortars; the secret, however, lies merely in the successful use of a pozzolana in conjunction with properly slaked lime, either "fat" or "hydraulic," and there are now available not only the identical materials used throughout centuries by the Roman builders, but also a range of both natural and (more recently developed) artificial pozzolanas from many different and widely distributed sources. It is possible today to specify lime-pozzolana mortars for use under exacting conditions, which will certainly equal the old Roman mortars in endurance and strength.

DEFINITION OF A POZZOLANA—A substance is said to be pozzolanic when, while not necessarily cementitious by itself, it possesses constituents which will combine with hydrated lime at ordinary temperatures in the presence of moisture to form stable insoluble compounds of cementitious value. When mixed with lime mortar in addition to, or in partial substitution for, sand, it will impart hydraulic properties and greater strength.

Pozzolanas and Portland Cement

Additions of pozzolanic substances to portland cement mortar and concrete are of great importance. Set portland cement contains free slaked lime, and this compound is very easily attacked by many chemical substances and is the cause of most of the efflorescences on cement products.

The addition to cement of a material capable of combining with the free lime renders it much less affected by the action of various chemically destructive agencies; also the resistance of portland cement to injury by severe heating can be materially increased by a pozzolanic addition.

Types of Pozzolanas Available

A large number of substances fall within the definition of a pozzolana given above, but a material will generally only come into practical consideration if it is available in large quantities and at a low price in the vicinity of the works where it is to be used: it thus corresponds more closely with sand than with, e.g., portland cement, which may in some cases be economically shipped halfway across the world, so that only a reasonably close supply of a natural pozzolana, or else some (otherwise almost valueless) by-product of a local industry, can be considered if the normal cost of finished work is not to be exceeded.

Classification and Sources

Pozzolanas may be classified as follows:

A. Natural Pozzolanas†
- Italian pozzolanas.
- Santorin earth (Greek).
- Trass (Rhine district and Bavaria).
- Volcanic ash deposits in S. E. France, Azores, Canaries, Japan.
- Diatomaceous earth.

B. Artificial Pozzolanas
- Granulated blast-furnace slag.
- Pounded bricks and tiles (certain varieties only).
- Burnt clay (Indian "Surkhi").
- Furnace clinker.
- "Si-Stoff" (residues from alum manufacture).

C. Dual Type Pozzolana
- Gaize.

Natural Pozzolanas

ITALIAN POZZOLANAS AND SANTORIN EARTH—As indicated by Vitruvius and other ancient writers, the volcanic ash from the neighborhood of Mount Vesuvius was the material generally used by the Romans; around Pozzuoli, near Naples, at Civita Vecchia, and near Rome there are quarries which have been in use for many centuries. Other sources were the sand from the Greek Island of Santorin ("Santorin earth"), and somewhat similar deposits in the southeast of France.

TRASS—Trass is a rock of volcanic origin, composed of pumice fragments, which is found in Germany (Eifel district and Bavaria). In general properties it strongly resembles the Italian pozzolanas. The trass from the neighborhood of Andernach, on the Rhine, has been in use for a long period; since about the end of the seventeenth century it has been in frequent and increasing demand by the Dutch, German and Belgian engineers. Quite recently official specifications have been published in Germany, and trass has been used in many important commercial and military works there and in neighboring countries. Examples are found in the naval harbor at Wilhelmshaven, at Bremen, Bremerhaven, Emden, Kiel, Heligoland, on the Kaiser Wilhelm and North Sea Canals, and in a large number of dams and inland works and waterways, e. g., at Frankfort, Cologne, Muhlheim, Berlin, and on the Ruhr. It has been used in many railway bridges in Germany, and in the Cologne drainage system trass-cement concrete has been used for the large sewers. It has also been used in harbor construction at Antwerp, Ostend, Dunkirk, and in many parts in Holland. Trass has even been exported during the last twenty years to points as far distant as Valparaiso and Port Arthur, for use in harbor and railway construction; and

Editors' Note

ONE TROUBLE with lime as a mortar material is that it never "sets" in the sense that a hydraulic cement sets. It merely drys out, and has little strength. It may have strength enough for many purposes; but it would be better mortar for all purposes if it had more strength—as no one can deny.

One kind of lime that will set and harden and have strength is hydraulic lime. Hydraulic lime is used in Europe even for wall plaster. Hydraulic lime is of two kinds —natural, or lime made from an argillaceous limestone; and artificial, which is a mixture of high calcium lime and a pozzolana. The addition of a pozzolana to any high calcium lime used in construction would overcome some of the present handicaps of lime in the building industry.—The Editor.

*Reprinted from Bulletin No. 2, Building Research, Department of Scientific and Industrial Research, British Government, London, England.

†There are a number of other materials which show some small pozzolanic activity, such as certain sands produced by the decay of igneous rocks, "arenes," "psammites," etc.; these are of relatively small importance.

has been used in Great Britain, e.g., in works on the Lancashire and Yorkshire Railway, Newcastle waterworks, Leeds City Tramways, and Aberdeen Harbor works.

DIATOMACEOUS EARTH (KIESELGUHR, INFUSORIAL EARTH, DIATOMITE, TRIPOLI, ROTTENSTONE, ETC.)—Diatomaceous earth is a finely divided sedimentary deposit composed principally of the siliceous skeletons of small aquatic plants, "diatoms," and therefore consisting* essentially of silica (65-95%) in an extremely light and porous, amorphous condition, together with some combined water. This silica is largely soluble in alkalies. Generally the material has been laid down in fresh-water lakes or swamps, and is associated with peat. It occurs thus† in Scotland, particularly in Skye and Aberdeenshire, where deposits have been worked for many years, and some beds are as much as 40 ft. thick; it is also found in Ireland in County Antrim. The diatomaceous *ooze*, on the other hand, is a deep-sea deposit, consisting mainly of remains of Planktonian organisms, and free from terrestrial deposits.

On the Continent an important source of supply is at Naterleuss, between Hamburg and Hanover, where beds up to 150 ft. thick are found; the lower portions of this deposit contain much organic matter, and are calcined before use to remove this. The Danish "moler,"* or moss-clay, is an argillaceous substratum to native peat deposits, and contains up to 70% of silica, of which up to 43% may be "soluble" silica. Enormous deposits of diatomaceous earth occur in the United States, some up to 1,000 ft. thick; that from the Santa Barbara district of California has recently been the subject of experiments in connection with the Los Angeles aqueduct. In North Carolina a 1925 specification for diatomaceous earth in connection with state highway concrete construction (for use in small proportions to improve working qualities) required that it should be "Plankton marine diatomaceous earth" free from clay and crystalline silica, with not more than 15% retained on a 200-mesh sieve, and not less than 55% remaining in suspension in a settling test in water; with not more than 10% of moisture, nor more than 6% loss on ignition of moisture-free sample; on the ignited sample it should contain at least 92% of silica and not over 4% of alumina.

The principal application of this bulky, porous material is as an *absorbent*, particularly in dynamite. It is used as a filler and paint material; for heat and sound insulation. "Tripoli," the more compact variety from Tripoli and Bohemia, is used as a polishing material. The more porous diatomites will absorb four times their weight of water, and are almost as light as cork.

The Harbor Works Department of the Danish government have admitted the use of their local material, "moler," in the proportion of 27.5% of finely-ground and air-dry moler mixed with 72.5% of cement; although considerable variation in strength of the finished concrete has been observed with this addition.

Investigations by the United States Bureau of Standards (1924) suggested that the workability of portland cement concrete was improved by the addition of a few per cent of diatomaceous earth ("celite"), and it has been used in the U. S. A. for this purpose.†

Experiments at the Building Research Station on the rate of combination of various materials with lime in solution have shown that the American "celite" exhibits in a marked degree the power of absorbing lime, the activity being actually higher than that of Bavarian trass; suitable heat treatment of the celite further improved this activity.

Practical tests on the effect of adding American celite to sand-lime mortar have also shown, by tests of tensile strength of briquettes at different ages, that the material possesses marked pozzolanic properties. But the difficulty arises, in the addition of a high proportion of celite to lime-sand or cement-sand mortars, that, owing to the bulkiness of the material, a large proportion of gauging water is required to produce a plastic mixture; the shrinkages during drying are correspondingly high. It appears, however, that when very dry mixes are used, additions of celite are of similar value to corresponding additions of trass.

Apart from the use of a small proportion of diatomaceous earth in cement mixes to improve workability, the possibilities of shrinkage difficulties, and the extremely bulky, porous nature of the normal product, would appear to preclude the use of it as a *major* pozzolanic addition to mortars except for special purposes where such properties are not obnoxious.

GRANULATED BLAST-FURNACE SLAG—By far the most important artificial pozzolana at present is granulated blast-furnace slag. When ground and mixed with lime it generally exhibits good cementitious properties; this is, of course, the method of one test a mixture of five parts of finely ground blast-furnace slag with one part of slaked lime was prepared. The mixture was moulded at a pressure of 1 ton per sq. in. After 28 days' storage in water the preparing "cold process" slag cements. In crushing strength was found to be 2.3 tons per sq. in.

Artificial Pozzolanas

Ground granulated slag is also used extensively as an addition to portland cement, mixtures of certain proportions being known as portland blast-furnace cement. The British Standard Specification for this material demands a strength as high as that of ordinary portland cement. These portland cement-slag mixtures have special advantages for certain purposes. The lime which is set free from the portland cement in the mixture plays a part in the setting of the blast-furnace slag. When the setting action is completed, the cement contains much less free lime than ordinary-set portland cement.

POUNDED BRICKS AND TILES ("POTSHERDS")—Ground potsherds were used by the Romans for making hydraulic mortar and were apparently highly pozzolanic. A large proportion of modern clay products are not found to be very active, doubtless because they are burnt at higher temperatures than the ancient materials.

BURNT CLAY—In India, for centuries, the native builder has used "surkhi" or burnt clay as a pozzolanic addition to lime mortar; this custom has also received official recognition by Anglo-Indian civil engineers. Burnt bricks and clay burnt *en masse* have often been used as mortar ingredients in Great Britain in the past, not always with the definite idea of taking advantage of possible pozzolanic activity. All clays do not seem to be equally suitable for preparing pozzolanas. No complete explanation of this variation is known as yet. The temperature at which the clay is burnt is very important and apparently varies for different clays.

In certain fire-resistance tests some River Humber clay used in the preparation of portland cement was examined; after heating to 850 deg. C. it possessed good pozzolanic properties, while divergences of 100 deg. C. above or below this temperature produced a material of much smaller activity. Some clay dug in the grounds of the Building Research Station at Garston, Herts, has been examined and found to be much less affected by variations in the burning temperature. The optimum temperature was found to be at about 650 deg. C., but material of appreciable pozzolanic value was produced by burning at any temperature between 550 deg. C. and 800 deg. C.

There is no doubt that there are many clay deposits in Great Britain only requiring light burning to develop excellent pozzolanic properties, thus providing a cheap home supply of pozzolanic material. In building or engineering works on a clay site, when a considerable amount of leveling for foundations is necessary, it is often cheaper to burn the excavated clay for ballast than to buy other ballast and pay for carting and dumping the clay. Occasionally, when railway cuttings in clay are being made, the clay is burnt to ballast in order to dispose of a waste material, the ballast being used for paving or, when well burnt, for concrete aggregate.

In burning ballast a small wood fire is started, which is then fed with lumps of clay mixed with coal slack. When the heap

*Davis, C. W., *Rock Products*, 1927, 29, 2, 37. Serial No. 2718, U. S. Bureau of Mines.

†*Memoirs of Geological Survey*, 1917, 5, 37. Audley, J. A., *Silica and the Silicates*, London, 1921.

*Poulsen, A. V., *Proc. Int. Assn. Test. Mat.*, 2 (10), 16. *Tonindustrie Zeitung*, 1913, 37, 1132. Danish Patent No. 16262, 1910; British Patent No. 24812, 1911.

†Conner, C. N., *Engineering News Record*, Dec. 17, 1925, 995.

is about 6 ft. high, further additions of clay and slack are made to the sides, and the process is continued until the heap contains two to three thousand cubic yards. In normal weather a ton of coal slack burns 10 to 14 cu. yd. of ballast; the burning of a full-sized heap takes from two to three months. After the clay has been excavated the labor costs for piling and burning and the fuel cost amount to 6s. or 7s. per cu. yd.; though these costs are obviously much influenced by the cost of transporting the raw clay and the convenience of the burning site.

A sample of burnt ballast from a railway cutting near London, when ground and mixed with lime, was found to possess a considerable degree of pozzolanic activity. It is probable, therefore, that further experience will show that in this direction lies one of the most likely sources of a good, low-priced pozzolana for general use in this country.

FURNACE CLINKER—The clinkers from the burning of coal in furnaces have been found to possess pozzolanic properties in a few cases; on the other hand, some samples are quite inactive, and no certain reason for this difference is known. The great variability of this material is likely to militate against its use as a pozzolana.

The pozzolanic properties of certain furnace clinkers are utilized, perhaps unconsciously, in many parts of England in making mortars. Clinkers are ground with lime in a mortar mill and the mixture is used as a mortar in masonry work. Frequently the mixture attains an intense hardness in the course of a few years, rivaling the hardness of portland cement. In such cases the clinker takes a part in the binding action and is not merely an inert aggregate like sand. In other instances, owing to the variability in the properties of clinker, the mortar remains quite friable.

"SI-STOFF" (SILICEOUS MATERIAL)—From recent Continental literature* it appears as if a by-product of the heavy chemical industry, known on the Continent as "Si-Stoff," can vie with the natural trass both in hydraulic and strength-imparting qualities. It contains a very large proportion of silica in an active form. The practical value of it will obviously depend on its proximity to the place where it is to be used.

SPENT OIL SHALE—A by-product of the shale oil industry of Great Britain, available in very large quantities, is the spent shale remaining after distillation of the oil. Practical trial at the Building Research Station of specimens of shale not specially prepared for this purpose has yielded results which appear to be promising. When tested in conjunction with a "fat" hydrated lime and sand, tensile strengths were obtained of the order to be expected in an effective pozzolanic mixture, at one to three months, of some 250-300 lb. per sq. in.; and very much higher than the exceedingly variable and moderate strength of from 15 to 50 lb. per sq. in. to be expected from a plain fat lime-sand briquette at the same period, in air storage, and with only the fortuitous slow process of carbonation to develop any reasonable strength. It is very probable that by some small alterations in the process of manufacture a uniform product might be obtained, whilst still a "by-product," which would show excellent pozzolanic properties. There is room for a great deal of experimental work in this direction.

"LINK TRASS"—"Link trass" is the name given to an artificial material, recently introduced as a substitute for the natural trass in Germany, prepared from a mixture of finely-ground blast-furnace slag and burnt clay.†

Dual Type Pozzolana

GAIZE—Gaize* is a natural siliceous material, consisting of a clay cemented by gelatinous silica, which occurs over a large area in the Ardennes. Particularly when burnt and ground, this material exhibits marked pozzolanic properties.

The Nature of Pozzolanic Action

Whether added to slaked lime, or to portland or similar cement which throws out hydrated lime in the course of its normal setting, the action of a pozzolana is to combine with this free lime and thereby render it insoluble and inactive. Precisely to what particular ingredient or ingredients in the pozzolanic substances this action is due is not quite clear. Certainly most active pozzolanas are rich in silica and often show a considerable proportion of what is termed in analysis "soluble silica"; but further investigations show that there is no distinct relationship between "soluble silica" and pozzolanic activity, at least in natural pozzolanas. Alumina may be quite as active an ingredient; thus aluminum fluoride, a pure chemical, when added to slaked lime, will immediately liberate an aluminium hydrate closely related to alumina, and actually imparts rapid-setting qualities to the lime (Holmes and Fink, U. S. Patent No. 1554183, 1925). Many pozzolanas contain much alumina. A typical analysis‡ of active natural pozzolanas will run:

	(Extremes of 31 samples) Per cent
Silica	42-66
Alumina	15-17
Iron oxide	4-19
Lime	3- 7
Magnesia	5- 7
Water	4- 9

Since the degree of burning, or particular thermal treatment has a very great influence on the activity of artificial pozzolanas, it is possible that the activity may be wholly or partially due to certain chemically reactive complex compounds of silica, alumina and possibly alkalies; thus certain zeolites, which are hydrated silicates of alumina with alkaline earths, are markedly reactive with lime, and have been suggested for use as pozzolanas.

The actual effect of the pozzolana is to combine with the lime to form insoluble silicates and aluminates. To this action is due the power that pozzolanic mixtures possess of setting under water, and in the absence of the atmospheric carbon dioxide which is necessary for the hardening (as distinct from merely "setting" whilst drying) of ordinary fat-lime mortar. Pozzolanic lime mortars, therefore, are able to acquire considerable strength even in damp positions, under water, or in the center of a mass of masonry, in positions where pure lime mortar would never really set. The action with portland and similar cements is analogous: the pozzolana forms insoluble compounds with the free lime liberated in the process of setting of the cement.

The experience of Continental engineers* is that up to 30% of the cement in portland cement concrete can be replaced by trass without appreciable loss of strength; and that, by the addition of trass, to the extent of one-third to one-half of the volume of the cement used, to a normal mixture, not only the tensile and compressive strength, but also the impermeability and powers of resistance of the concrete to various agencies (especially sea-water) are markedly improved. In both cases, under Continental conditions, the price of the concrete is sensibly lowered, as trass costs less there than portland cement. This would not necessarily be the case in Great Britain, as the prices of available pozzolanas may differ greatly.† Striking evidence is advanced in recent technical literature to show the greatly improved resistance to the action of sea-water and dilute acids imparted by the addition of pozzolanas to cement concrete.‡

Testing the Activity of Pozzolanas

The activity of a pozzolana will be greater the more finely it is ground. Hence, in estimating the value of a sample of, e.g., trass, the degree of fineness should be examined, preferably by sieving; failing this, rubbing between the fingers will indicate by a gritty feeling that coarse material is present. A pozzolana should be ground not less finely than ordinary portland cement.

At the present time, owing to the fact that so little experimental work has been carried out on pozzolanic activity, the safest test is a practical one. The setting properties of the pozzolana should be tested by actually mixing with lime and observing the be-

*Bach, *Tonind. Z.*, 1926, 50, 16, 253.

†Haavardsholm, *Teknisk Ukeblad*, 1925, 72 (48).

*Feret, R., *Rev. Mat. Constr. Trav. Pub.*, 1926, 201, 165. Cayeux, L., *Mem. Soc. geol. du Nord*, 1897, 4 (2).

‡Eckel, *Cements, Limes and Plasters.*

Vide Kiepenhauer, *Kalk und Mortel*, 144.

†Richard, W., *Tonind. Z.*, 1926, 50, 16, 251.

‡Feret, R., *Rev. Mat. Constr. Trav. Pub.*, 1926, 202, 203, 204, Habling and Von Bulow, *Bauingenieur*, 1925, 6, 3, 76. Grun, R., *Zement*, 1921, 474; 1922, 149.

havior of the mixture over a period. The pozzolana to be tested should be mixed with about one-half its weight of dry slaked lime or a weight of fat-lime putty equivalent to this. A mixture of suitable consistence is made into a pat on a glass plate and left in moist air to set and harden for some weeks, during which period it is occasionally examined. For purposes of comparison it may be advisable to prepare a pat of lime putty and store in the same manner. For storage in moist air a wooden box may be used, covered with a piece of sacking which is kept wet. Under such conditions the setting of lime paste will be very slow, and any chemical combination between the lime and the pozzolana will be revealed by the more rapid rate of hardening of the pozzolana pat. Different pozzolanas will differ in the rate of hardening. Granulated slag will probably produce an intensely hard pat in a few days, while clinker or burnt clay may require weeks or even months to give any appreciable degree of hardening, depending to some extent upon the fineness of the grinding. Even if the pat fails to set quickly, the material should not be at once rejected as useless as a pozzolana; the rate of combination with lime may be slow, but the action may be none the less sure.

Base Plates for Emley Plasticimeter

THE EMLEY PLASTICIMETER for the determination of the plasticity of hydrated lime was developed at the bureau and is fully described in *Technologic Paper* No. 169, "Measurement of the Plasticity of Mortars and Plasters." The instrument has been adopted by the Federal Specifications Board and the American Society for Testing Materials as the standard for measuring the plasticity of hydrated lime. Those familiar with the plasticimeter will recall that an unglazed porcelain plate, 4 in. in diameter and 1 in. thick, is used to simulate the action with reference to absorption of the scratch and brown coats of plaster. It is obvious, and has been corroborated by test data, that the rate of absorption of the plate influences to a marked degree the "plasticity figure" of the lime. Unfortunately, the purchasers of plasticimeters have received plates differing in rate of absorption from those used at the bureau, which have the following rate of absorption over an area equal to that of the test specimen:

Time (in minutes)	Absorption *ml*
1	9
2	5
3	5
4	4
5	4

For some time the bureau, in co-operation with the makers of the plasticimeter, has been making an effort to obtain an unlimited supply of base plates of the proper characteristics. Only recently has success been achieved. About 1200 plates have been received, which are being evaluated as rapidly as possible. To date those tested have a rate of absorption very close to those used at the bureau and are very uniform with respect to this property. On completion of the work of evaluating the rate of absorption of the plates they will be turned over to the manufacturer of the instrument, then those wishing them may obtain any number of plates of the proper characteristics, and plasticity determinations by one operator will be comparable with those made by other operators or laboratories.—*Technical Bulletin* of the U. S. Bureau of Standards.

The Gilsonite Deposits of Utah

GILSONITE, one of the world's oddest minerals, is mined only in the state of Utah, according to the United States Bureau of Mines, Department of Commerce. It is a brilliant, black, asphaltic substance, and is used in the manufacture of varnish, paint, electrical insulation, inks, telephone mouthpieces and many other commodities.

Gilsonite was discovered in the Ashley valley in the Uintah Basin, Utah, in 1878 and was at first thought to be a variety of coal. Later Prof. W. P. Parker discovered it to be a member of the asphalt group and named it "Uintaite."

Samuel H. Gilson and Bert Seabolt became interested in these deposits and the former spent many years in his efforts to find a market for the Uintaite. His enthusiasm was regarded as more or less wasted by the people of the vicinity and the term "gilsonite" was locally applied to the Uintaite. When Gilson's efforts finally developed a market the name gilsonite had become firmly attached to this substance and it is now so known throughout the world.

After more or less successful exploitation of the deposits, involving the hauling of the ore as far as 125 miles to a railroad, in 1902, the demand for the material became so great that better methods of placing it on the market became necessary. The Black Dragon vein was developed, and by 1904 enough ore was accrued to warrant the construction of the Uintah railway connecting the Dragon mine with the Denver and Rio Grande railroad at Mack, Colo.

Gilsonite occurs in veins in a solid homogeneous mass and breaks with a conchoidal fracture. The surface ore melts at about 400 deg. F. and is used principally as a saturant of felt in the manufacture of roof and floor coverings. With increasing depth it usually becomes better in grade and is known as "select" ore which melts at 275 deg. F. and is used in the manufacture of high-grade paints, varnishes and electric insulation. Although gilsonite lacks any elastic properties, it makes a varnish whose elasticity is remarkable. A thin piece of tin coated with good gilsonite varnish may be bent repeatedly without the coating being cracked.

Various theories have been advanced as to the formation of these veins. The most plausible theory appears to be that the formation of this great synclinal basin resulted in gigantic cracks in the brittle and non-elastic sandstone measures of the Uinta formation with enough heat to distill the oily matter in these carbonaceous measures from the underlying Green river shales. The mining of gilsonite, unlike that of coal or other ores, requires no elaborate surface plants. The gilsonite ore does not have to be prepared and, as it is sacked and made ready for shipment in the mine, the only loading equipment necessary is a platform from which the sacks of ore are transferred from the mine car to railroad cars. The ore outcrops at the surface where mining is started and progresses inward and downward, all of the ore of the vein being removed. In working, a system of slopes and benches is used. Due to the highly inflammable nature of the ore, no attempt has been made to use explosives in mining. The ore is sufficiently brittle so that a sharp pick can be driven into it easily.

More detailed information in regard to the mining of gilsonite is contained in Information Circular 6069, copies of which may be obtained from the United States Bureau of Mines, Department of Commerce, Washington, D. C.

Book on Soil Treatment Has Agstone Discussion

A COPY of the second edition of "Soil Management," a book on scientific treatment of soil for increasing its productive capacity has recently been received. The book is the work of Dr. Firman E. Bear, professor of soils at the Ohio State University, whose work in soil treatment has made him a well-known authority on this subject.

The most interesting portion of the book to rock products producers is the section devoted to supplementing soil resources. There is one chapter given over to agricultural limestone entirely, which forms an excellent treatise on the requirements of lime intended for use on the soil, since it includes a careful study of the characteristics of limestones of various chemical compositions, the effect of fineness of grinding, and similar data. A discussion is given of the relative merits of the various liming materials, the neutralizing powers of the materials, and their different solubilities. The advantages of burned lime and unburnt limestone are discussed. A portion of the section is given over to the use and application of limestone on the soil, and another portion compares lime with other soil-treating materials. The book affords an excellent opportunity for obtaining information which is of unquestionable value, particularly in merchandising agricultural limestone where it is necessary to place the facts before a customer in plain straightforward fashion.

Mortar, Its Importance in the Life of Brickwork*

By Prof. J. A. Van der Kloes
Delft University, Holland

IT IS MORE than 45 years ago since the author first began to investigate defects in mortars and to attempt to discover which properties were suitable and which were detrimental for mortars used under various conditions. At that time little or no attention was paid to the subject, and builders merely repeated what they had learned without much idea of seeking improvements. In the last 40 years, however, many changes have been made—some, alas, for the worse—however the general knowledge of mortars has increased, especially in Europe.

That the application of scientific methods of investigation of mortars has been much more appreciated in Holland, Germany and France than elsewhere is shown by the fact that the author's "Manual for Masons" has passed through seven editions in Holland and Germany, but only one edition has been needed for England and the United States. Whether this is due to apathy or ignorance on the parts of architects and builders or to other causes is difficult to ascertain, yet it is a fact that many American and English architects and builders are constantly making serious mistakes in the specifications or instructions they issue with regard to the composition of mortars for various purposes.

The scientific investigation of mortar attracted little or no attention until 1909, when the author read a paper on "Some Consequences of the Use of Wrongly-Compounded Mortars," the result of which was the formation of an international committee to investigate the subject generally. The war sadly hampered the work of this committee, but it was revived at an International Congress for Testing Materials held in the middle of September, 1927.

Two of the chief properties of defective mortar are the increase in its volume which occurs during the crystallization of the lime compounds and the scaling of brickwork and masonry, which is due to osmotic pressure. These properties have been intensively studied by the author for some years and though his earlier suggestions respecting them were disputed by Hirschwald and others, they have been amply confirmed by more recent work.

*From *Brick and Clay Record*, June 19; Reproduced by courtesy of the publisher.

As explained in the "Manual for Masons" (J. and A. Churchill, London) the author has long been convinced that much of the scaling or spalling of stone, brick and concrete structures is due to the internal pressure caused by the expansion of material within the pores. Frost—to which scaling or spalling is usually attributed—has nothing to do with it, because it occurs just as freely in the absence of frost. That an expansion does occur when a solution crystallizes may be demonstrated in the following manner, as recently suggested by Van der Wallen: a small flask with a very narrow neck is filled to the base of the latter with a solution of sulphate of soda, saturated at 33 deg. C. After some time the height of the liquid in the flask will have increased, to an extent which depends on the degree of saturation and on the temperature. An increase in volume of 0.7 to 0.9% is sufficient to account for the destructive effect of soluble scale on masonry and an increase of 0.25% when a plaster of paris paste solidifies is sufficient to crack any ordinary glass vessel containing such a paste. On again warming the solution in the flask to 3 deg. C. the crystals will melt and the volume will contract to its original amount, but will again increase as the liquid cools and crystallization occurs. This phenomenon is precisely similar to what occurs when water freezes into ice, but in the latter case the expansion is about 10 times as great.

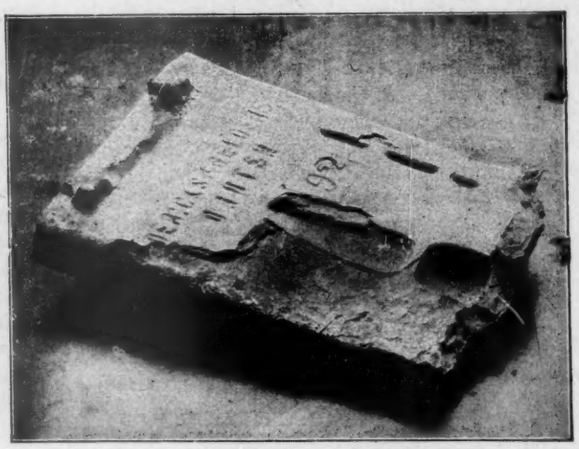


Fig. 4. Showing a remarkable phenomenon which occurred in a tile shed used for slaking lime

The second cause of spalling—osmosis—is less obvious and for a long time the author had no clear idea of the real cause. Osmosis may be described as the passage of salts or other substances in solution through semi-permeable membrances, and such passage is accompanied by the development of pressure. Investigations made prior to the World War convinced the author that scaling or spalling often occurs with stone or brick in which the pores are permeable to pure water, but are too small to be permeable to some solutions. Such materials act as semi-permeable membranes and when they are wetted by rain, pure water penetrates the pores and the solution of any soluble salts tends to pass in one direction, while the purer rain water passes in the opposite one. The result is that an osmotic pressure is set up which, in some cases, may be great enough to burst the walls of the pores and eventually to cause pieces of brick or stonework to flake and fall away.

An important discovery has recently been made by Joosting, who found that on tapping masonry or brickwork, as when testing its soundness, the color of the material changes momentarily at the points where it is struck. In many instances, the change in color would pass unnoticed, but in some it is so marked as to attract immediate attention. Joosting eventually found that the change in color is due to the expulsion of a liquid by the impact of the hammer. The total quantity of liquid expelled is very small, but it is sufficient to form a stain which gradually spreads until, in some cases, it reaches to the edges of the brick and may even extend through a joint of cement-mortar into an adjacent brick. In one instance examined by Joosting the stains persisted through five weeks of hot, dry weather. Fig. 1 shows two brick which had been tapped by a hammer, the resulting stains being shown in Fig. 2, which was photographed six minutes after the tapping. The stains show white in the illustrations, but actually they are rose pink—a color which shows up clearly against the grey-brown background of the brick. Near the right-hand stain a little loose pink powder may be seen. The tapping which caused the left-hand stain produced a horizontal strip of moist brickwork below the joint, which in less than six minutes had spread into the

Fig. 1, Above. Showing two brick, which had been tapped by a hammer, the resulting stains being shown in Fig. 2, left, which was photographed 6 minutes after the tapping. Stains show white in the photographs but actually they are rose pink

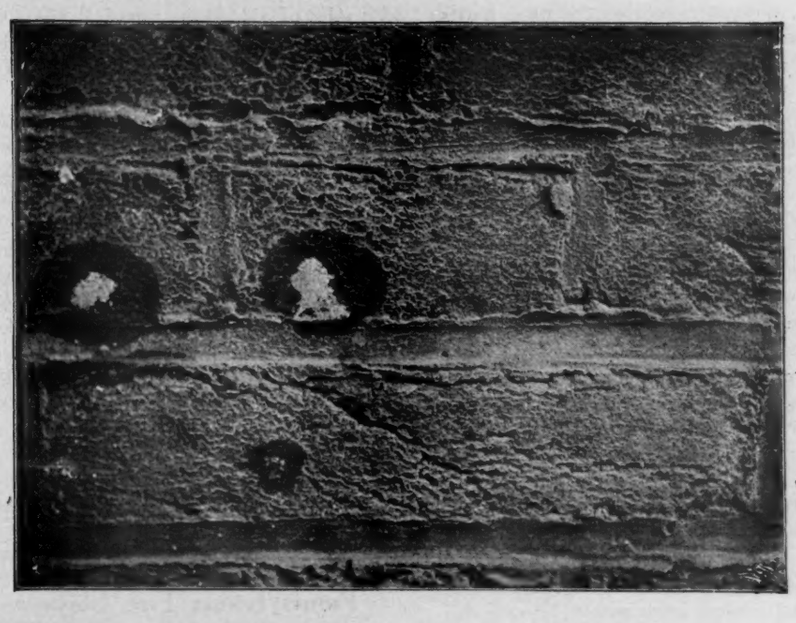


Fig. 3. Showing how the stains gradually spread. This photograph was taken 12 minutes after the brick, shown in Fig. 1, had been tapped by a hammer

stretcher and the adjacent mortar and ended at a crack through which water was escaping. On the stretcher below an accidental blow from the hammer also produced a small, moist stain, its lesser size being due to the lighter impact. The stains gradually spread, as shown in Fig. 3, which was taken 12 minutes after tapping.

Origin in Layer of Osmotic Cells

Sometimes several small dark lines in the form of a star appear immediately after the blow of the hammer; these lines gradually extend and form cracks through which the liquid escapes. It was observed that at two points close to a spot where crusts of carbonate of lime were present the liquid oozed out drop by drop and slowly flowed along the brickwork. It was later found that if the surface of the brick was scratched with a sharp-pointed tool to a depth of less than 1/16-in. the effect was the same as tapping with a hammer, the edges of the scratch being marked by moist bands and, in one instance, several drops of liquid oozed out. The origin of this peculiar phenomenon is probably to be found in a layer of osmotic cells filled with a saturated solution of lime and being in such a state of tension that a sudden blow or scratch is sufficient to liberate the liquid.

Fig. 4 shows a remarkable phenomenon which occurred in a tiled shed used for slaking lime. The tiles were *in situ*, apparently sound and had shown no signs of leakage, when it was accidentally found that they were "as open as basket work" and fell to pieces when lifted. The iron trusses in the roof were corroded by the same cause and to such an extent as to make the building dangerous. This result was due to several causes, lime-dust, heat and cold, dryness and damp following each other alternately had, in less than a century, decomposed the baked clay of

which the tiles were made! Lime when slaked by hand so as to form a dry hydrate produces such fine dust which settles on the roof and elsewhere. When steam or moisture from the air condenses on this lime it dissolves some of it and the solution is absorbed by the tiles and the lime deposited in the pores. The moist deposit attracts carbonic acid from the air, forms carbonate of lime and this dries under the influence of sun and air. When a further condensation of moisture occurs on the under-side of the tiles, the adjacent pores are filled with lime water, the walls of the pores being lined with a semi-permeable deposit of carbonate of lime. If rain then falls on the tiles, all the conditions are present for producing osmotic pressure. Rain-water enters the pores through the semi-permeable wall, lime-water cannot pass out and so on osmotic pressure arises in the pores, the walls of which are ruptured and a small flake or scale separates from the tile. This process, repeated indefinitely, eventually destroys the tiles—a striking instance of the great effects which may result from an apparently trifling cause. Such an occurrence is capable, in time, of destroying the thickest walls, of causing irretrievable damage to towers and other public buildings as well as to those of lesser importance. A further interest attaches to this matter inasmuch as the destruction is brought about solely by lime and water and is independent of such questions as the proportions of the ingredients in the mortar or the manner in which they are mixed together.

It cannot be too clearly understood that the presence of free lime in a mortar exposed to moisture may be the cause of scaling in the brickwork or masonry in which such mortar is used. Hence, it is very important to fix the lime by using, in the mortar, a sufficient amount of pozzuolanic material, such as trass, or finely-ground brick or tile dust. It has been shown as the result of definite experiments that two measures of portland cement, when wetted, liberate sufficient free lime to combine with one measure of trass, but it has also been found in various structures in which cement and trass are used in these proportions the quantity of trass is insufficient. It has also been found that an insufficiency of trass may actually aid the formation of efflorescence of wall-white instead of preventing it. This has been proved in the construction of the Maas-Waal canal, in which the author has succeeded in applying the ancient Roman method of building to modern tamped concrete. Knowing, from experience, the dangers which may arise if too little trass or pozzuolanic materials are used with portland cement, the author always prescribes equal measures of these materials, though Hyner, at the Hague, has successfully used one part of cement with three-quarters of a part of trass.

Most English and American builders seem to be unaware of the fact that the addition of trass or its equivalent to a cement-mortar increases its plasticity and so makes it much easier to use. Very fine sand has a similar effect on the plasticity, and Hyner, who normally employes 1 measure of cement, ¾ of trass, 3 of coarse river sand and 3 of fine sand, has been able to increase the proportion of fine sand to 4 parts, making a mortar containing 1 part of cement to 7 of sand without the bricklayers raising any objections to its use. In other words, it seems both unnecessary and undesirable to spoil cement-sand mortar by adding lime to it in order to make it more plastic; trass or fine sand will produce the desired effect without the other disadvantages which accompany the use of free lime in mortar.

Magnesium in 1927

SALES of magnesium produced in the United States during 1927 amounted to 366,400 lb., valued at $441,700, as compared with sales of 322,650 lb., valued at $390,400, in 1926, according to J. M. Hill, of the United States Bureau of Mines, Department of Commerce.

Some 69% of the magnesium sold in 1927 was in ingot form at prices ranging from 58 cents to 93 cents a pound, and such sales increased over 6% as compared with 1926. Sales of sheet magnesium in 1927 were 3% of the total sales of magnesium and were 159% greater than in 1926. Sales of castings in 1927 were 31,990 lb., a decrease of 13% as compared with 1926. Sales of wire decreased 13%, but those of tubing increased 94% as compared with 1926. The average price of domestic ingot metal in 1927 was 68 cents a pound, that of powder $1.56 a pound and of castings $1.84 a pound.

Imports of magnesium metal in 1927 were 7131 lb., valued at $8,402, as compared with 10,117 lb., valued at $4,750, in 1926.

Pennsylvania Fire Clays

PENNSYLVANIA is a great producer of the refractories used in the rock products industry and the fact that the resources of the state in fire clays of the best quality is quite limited is therefore of interest.

In Bulletin No. M 10 of the Pennsylvania Topographic and Geologic Survey, the author, J. B. Shaw, says that this is true of the high grade clays in spite of the fact that enormous quantities of fire clay are associated with the coal seams of the state. He says that the supply of No. 1 clay does not always fill the demand and that this condition is not likely to improve.

It has not been determined, according to the bulletin, whether the diaspore clay mined in Missouri, from which high alumina refarctories are made, exists in Pennsylvania or not. But there are deposits of nodular clay which approached the Missouri clay quite closely and these are being worked by manufacturers. It is the author's opinion that larger deposits than those worked probably will be found in Pennsylvania.

The bulletin is largely made up of tables and diagrams giving the physical and chemical properties of many clays in the state and descriptions of their occurrence. A more complete survey may be undertaken later.

American Refractories Institute Bulletin

THE technologic paper, "Some Refractories Which Are in a Developmental Stage," is a short bulletin of 13 pages containing a few suggestions in several different fields of refractory application. It is not a record of completed researches.

The diaspore clays of Missouri and the mullite type of aluminous refractories are discussed, considerable attention being given to mullite and minerals which invert to mullite upon heating, such as andalusite, sillimanite and cyanite. Some experiments with dolomite and chrome-diaspore refractories are given a brief discussion.

C. A. Bole, research professor, Engineering Experiment Station, Ohio State University, Columbus, Ohio, is author of the bulletin. Copies of the paper may be obtained by writing the American Refractories Institute, Oliver Building, Pittsburgh, Penn. A charge of 50 cents per copy is made.

A New Acoustic Plaster

THE new sound absorbing plaster "Calacoustic," manufactured by the Standard Gypsum Co. of Seattle, Wash., is reported as meeting with considerable success in the field of acoustic plasters. It is essentially a gypsum base wall plaster which can be applied directly over concrete, tile or masonry walls and the brown or finish coat over a hardwall scratch coat on metal lath, wood lath or plaster lath construction.

Calacoustic is claimed to have an average tensile strength equal to that of hardwall plasters and to have a covering capacity from 90 to 100 yd. per ton when applied ½-in. thick. It is fireproof.

A noteworthy feature is that this acoustic plaster may be colored to any desired tone or tint, the color penetrating all way through the material.

High Temperature Cement Booklet

THE GENERAL REFRACTORIES CO. has compiled a new 19 page illustrated booklet entitled "Choosing a High Temperature Cement," with a view toward assisting the customer to select the type of cement best suited for his needs. The action of various types of high-temperature cements under the attack of slag, their resistance or tendency to shrinkage and spalling, performance at high temperatures and use of patching, all are plainly discussed and illustrated.

The Natural Cement of Vassy*

Natural Cement Rock of Vassy, France, Burned in Shaft Kilns Shows Remarkable Properties That Could Be Well Imitated in Portland Cements

By G. Bidaut de l'Isle

BEFORE 1830 France imported cement from England. It was during the year that a well-known French geologist from Avalon, Honoré Gariel, having become aware in a rather casual way of the excellent hydraulic properties of certain argillaceous limestones of that region, undertook some tests which proved that upon calcination, these limestones, of which there were numerous deposits, produced a cement of excellent quality. He established at Vassy, near Etaules (Yonne), in the vicinity of the deposits first discovered, a small plant in which the limestone was ground and sifted by hand. Numerous tests were made during a period of years which led to most conclusive evidence.

Encouraged by the results of these tests and by engineers who had followed his work, he built, in 1832, together with his brother, Hippolyte Gariel, and Garnier, a small plant, consisting of two kilns and two crushers, driven by horses.

During the years which followed, the reputation of the Vassy natural cement was growing continuously. In 1840, fifteen crushers, operated day and night, could not satisfy the demand. In 1855 the first steam engine was installed, which made it possible to furnish 100 tons of cement per day. It was at this time that different plants were found in this vicinity, along the deposits which, beginning at Vassy, extend into the basin formed by the Serein valley and which stop at the north end of the valley.

Quarrying

The rock quarried belongs to the Jurassic formation. The limestone strata are below the latter and on top of the liassic formations; several stratified layers of this limestone alternate with a highly argillaceous limestone.

These deposits, particularly prevalent in the Avalon region, disappear in the other parts of Auxois, as indicated by Collenot, member of the French Geological Society, who is an authority on the subject.

Quarrying is done in twenty-five open quarries, most of which are directly connected by lines of track, conveying the rock to the plants, where it is crushed near the kiln. The limestone is burned in continuous kilns at a temperature of about 1000°C and is subsequently ground and pulverized.

Eight plants of this region are capable of producing 800 to 1000 tons of cement per day.

Chemical and Physical Properties

The rock which yields the Vassy natural cement is slightly bituminous and does not weather when exposed to air or cold; it is of a bluish-gray color. It shows a fine texture. When calcined, it loses 40% of its weight and becomes brownish-yellow. Its chemical composition before and after calcination has given the following results in analyses made at the Materials Testing Laboratory of the City of Paris*:

Befort Calcination	Per cent	After Calcination	Per cent
Silica	19.4	Silica	20.5
Alumina	5.9	Fine sand	3.3
Ferric oxide	3.0	Alumina	9.3
Calcium carbonate	63.7	Ferric oxide	5.5
Residue	8.0	Lime	50.0
		Magnesia	0.3
		SO_3	3.5
		Residue	6.7
	100.0		100.0

This chemical composition varies but little in the different quarries. One can, therefore, consider the Vassy cement as one of absolutely uniform chemical composition. It was this uniformity which brought about its success and permitted government as well as private contractors to class it among first quality products suitable for execution of important construction work.

The Vassy cement is a hydraulic cement; under the action of water it forms a double silicate of alumina and lime, which upon hydration rapidly yields a product of exceptional hardness. Used as mortar, it sets in air or under water, and acquires, cured dry and moist, a constantly increasing strength. After a few days of use it possesses properties of strength and adherence which can be obtained with the best hydraulic limes only after several years.

As it contains little magnesia, which is sometimes considered as detrimental to mortars, its strength increases practically indefinitely. The proportion of alumina to lime is such that all of the lime combines during calcination with silica or alumina, and upon formation of a double silicate, with an excess of silica left over, there is no danger of deterioration due to free lime.

Its weight, when pulverized, varies, depending upon the degree of settling and calcination, from 700 to 1000 kg. per cu. m. It is the lightest of all cements, and, as proportioning is generally done by volume, results in considerable economy for the contractor.

Fused cements acquire their strength 18 hours after mixing. However, they remain slow-setting cements, while the Vassy cements, so-called quick-setting cements, set within 5 to 15 minutes, with a maximum of 30 minutes. They are, therefore, suitable for use where fused cements cannot be applied, as they are the only cements which serve the purpose when a road is to be flooded with water, when work is carried on with constant seepage, when rush work is to be carried out, as, for example, repairs to dams. In a few hours it is possible to remove forms from sewers. The rapid-setting properties of Vassy cement are due mainly to its alumina content and to the formation—providing calcination is not too strong—of a strongly basic calcium aluminate as predominant constituent.

This natural cement has another remarkable property which it shares with fused cement to the exclusion of all other cements, and that is its resistance to the action of selenitious sea waters and to destruction by swelling, common to other cements, and which is due to the formation of a calcium-sulfo-aluminate, strongly hydrated. This property has been confirmed for a period of years by observations on Vassy cement mortar blocks immersed for some time and found perfectly sound at the end of several years. Other tests of the same nature were made by Anstett, in charge of testing laboratory of the city of Paris; the same conclusions were drawn with reference to the perfect resistance of Vassy cement in contact with calcium and magnesium sulfate solutions.

These results are not surprising when one considers that Vassy cement satisfies three important conditions which insure resistance to sulfate solutions: absence of free lime, impermeability (density) and rapid carbonation.

These special qualities have justified the use of Vassy cement on all types of construction work, particularly in hydraulic and sewer construction. The sewer system of the city of Paris, built with Vassy cement, has

*Translated from *La Nature*, by Margaret Arronet Corbin, Chicago, Ill.

*These are average values from a large number of analyses taken from tests of Vassy cements by Deval, director of the laboratory, at the time of the Universal Exposition in 1880.

never shown failures, either under abnormal pressures produced during the floods of 1910 or during the period of several years (1914 to 1920) when its upkeep was greatly neglected.

The excellent strength properties acquired by structures executed in Vassy cement protect them from chemical decomposition. The life of such structures may, consequently, be considered indefinite.

Uses

The cement mortar consists of sand, mortar and cement, properly mixed. The materials to be incorporated with the cement must be clean, as must be the surface of bricks or blocks to which the mortar is to be applied. Durability of the structure depends on this condition. Properly washed, their surfaces must be kept moist during application of the mortar. If the batch of mortar or concrete has set before use, it is not adequate for use and shall be rejected. As far as possible, the sand and water shall be kept at normal temperature of about 15°C. (60°F.). Heat accelerates setting, cold retards it.

The sand shall be screened and washed free of earthy matter. River water is to be preferred as mixing water, but other waters may be used, excepting saline waters or those containing calcium sulfates.

Sea water retards setting of mortar and produces on the surface saline efflorescence. Its use must be avoided for building construction; however, it is preferable for sea water construction, as it yields higher strengths.

The use of neat Vassy cement in the case of flooding, when rapid setting is required, is recommended. In other cases, the proportions of cement and sand vary according to use: Thus 1:1 mix by volume may be used for surface coat of reservoirs, cisterns, sewers; 1:1½ and 1:2 for ordinary surfaces, fine masonry; 1:3, 1:4 and 1:5 for coarse masonry; 1:6 and leaner for foundations of tamped or non-tamped mortar. Finally, it is used in concrete mixtures which acquire higher strengths with increasing cement content.

These proportions have been made subjects of numerous studies by engineers and manufacturers. Experiments with Vassy cement on construction jobs have proven its strength and durability.

Numerous structures were built of Vassy cement, among which are: Sewers of the city of Paris, Rennes, Orléans, Melun, Nancy, Reims, Angers, Troyes, Auxerre, Semur, Vichy, Nantes, etc.; the water pipes and reservoirs of Paris, the conduits of Vanne and Dhuis, the reservoirs at Auxerre, Nevers, Saint-Étienne, Versailles, etc.

The Department of Roads and Bridges, the engineering bodies and the railway authorities make continuous use of Vassy cement for ornamental work as well as for utility structures. Vassy cement was used in building and repairing most of the bridges and retaining walls of Yonne, Loire, the dams at Yonne, Pont and Massène, the lining of the tunnel of the Métropolitan (Paris subway), that at Blaisy-Bas, etc., and finally the canals at Briare, Nivernais, Bourgogne, Saint Martin and Saint Denis. The French naval service has made use of Vassy cement in the various ports.

The magnificent viaduct, consisting of a single arch at Pierre Perthuis, on the Cure, with a span 73.50 meters and height of 27.30 m.; that at Chastellux (132.6 m. span and 20.0 m. high), Montreuillon (133 m. span and 24 m. high), were built with Vassy cement. The restoration of the Pont Royal at Paris, of the surface of the d'Arcy tunnel on the Cure have required the use of the same cement.

The water works of the city of Nevers were built in chuted concrete of Vassy cement, as well as the arches of the great public hall of the Hôtel de Ville at Clermont-Ferrand, the rustic bridges in the bois de Boulogne, the stairs of the square Saint Pierre at Montmartre, the Château des Dames at Châtelet en Brie (Seine-et-Marne).

The various uses of the Vassy natural cement show the great adaptability of this cement and the almost indefinite number of uses it may be put to successfully.

Stone Preservation and Decay

THE most important cause of rapid stone decay today, especially in centers of population, is the crystallization of sulphate of lime within the stone or brick. Where large quantities of coal containing considerable sulfur are burned, sulphur dioxide (SO_2) is formed. This gas in the presence of air and moisture is converted to sulphuric acid (H_2SO_4) which, when brought into contact with any variety of calcium carbonate ($CaCO_3$), reacts with it to form calcium sulfate ($CaSO_4$). If it were only a matter of solution of stone, the decay would not be so serious, but as a matter of fact the calcium sulfate tends to form crystal centers, the growth of which ultimately shatters the stone surface.

Another source of stone decay is the formation of magnesium sulfate ($MgSO_4$). This decay is apt to take place where ground waters containing salts of magnesium come into contact with foundations built of limestone and react with the latter to form magnesium sulphate, which appears in the form of an efflorescence on the stone surface. The slow chemical action due to the solubility of carbonates in water and the presence of certain bacteria which produce acids also contributes extensively to stone decay.

Other natural causes of stone decay which may be regarded as purely mechanical in action are expansion and contraction caused by changes in temperature, alternate wetting and drying, wind erosion and expansion caused by freezing of water in the pores.

The mortar used in cementing lime or brick contains lime compounds in which a good deal of free lime is present, all of which are more or less attackable by sulphur acids. It is evident then that in mortar there is a source of supply of calcium sulphate which may, under certain condition, be drawn into the brick or stone, and, therefore, even though a silicious stone or brick free of itself from soluble lime compounds, is used, destruction may take place, either in the formation of calcium sulphate in the mortar or in the drawing of the solutions of calcium sulphate into the stone and there crystalling *in situ*.

Stone preservatives may be roughly classified into organic preservatives, such as paraffin wax, linseed oil, solutions of resins and soaps and into preservatives, which are meant to act upon the carbonate of lime contained in limestones and some sandstones, with a view to forming insoluble compounds, such as silicate of soda, arsenate of soda, and fluosilicic acid and its salts. The German chemist Hoffman suggested the use of silicon ester, a liquid, which, thinned with alcohol, can be soaked into a stone and on exposure to the air and moisture deposits a thin layer of hydrated silicate as a cement.

Ventilating passages along the foot of walls to retain as dry a wall as possible by causing a movement of air within themselves has been employed. Hosing down all wall surfaces, especially under cornices and carvings, two or three times during warm weather, so as to cause the rapid crystallization and washing away of salts, would probably do a great deal toward the preservation of limestone buildings. [Abstract—"Stone Preservation and Decay," by Prof. A. P. Laurie in *Stone Trades Journal*, March-April, 1928.]

European Potash Shipment to Cincinnati by Water

INCREASED interest in Ohio river traffic in recent years, resulting in a large increase in river shipments, and the installation of improved facilities for handling barge shipments, has resulted in the first cargo of potash to arrive by river coming into Cincinnati. The cargo, originating in France, arrived in Cincinnati recently.

The potash was shipped by steamer to New Orleans and then was carried on barges up the Mississippi and Ohio rivers.

A Dutch company has taken out a charter in Mississippi, and proposes to establish unloading and reshipping warehouses at various points on the Mississippi river for French potash.

On September 3, the *Roa* cleared from Hamburg, Germany, with 1500 tons of potash for Chicago and Milwaukee thus carrying one of the largest shipments of this material ever brought to the Great Lakes.

Digest of Literature on Nature of Setting and Hardening Processes in Portland Cement

Part VI.—The Chemical Significance of Rate of Set

By R. H. Bogue

Research Director, Portland Cement Association Fellowship,
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WHEN PORTLAND CEMENT clinker is ground without the addition of any foreign substance, the resulting cement is usually too quick-setting to allow of its being properly mixed and placed before setting takes place. It is therefore common practice to grind with the clinker 2 to 3% of gypsum, or its equivalent in SO_3 content of plaster of paris. This retards the set, giving the cement a reasonably long working life before the set takes place.

Introduction of Retarders

"The early history connected with the use of retarders in portland cement has been set forth in a most interesting manner in a personal communication from Robert W. Lesley.*

The rotary kiln cements when first made at the Atlas plant were so quick-setting as to be almost unsaleable and for a time almost destroyed the value of the new method of burning. Somewhere along in the early 90's, the exact date I cannot give you off-hand, there was brought to the Atlas company a French chemist by the name of P. I. Giron, who was made assistant superintendent, I think, and whose business it was to straighten out this quick-setting difficulty of the rotary clinker.

Giron, it appeared, had seen some pavements laid with concrete in France, and the workmen mixed with their water some gypsum, which is very plentiful, as you know, in that country, and in this way retarded the setting, which gave Giron an idea of using it to make cement slow-setting. In some way this information got to the Atlas people, who brought Giron to the United States, and he did make a rotary cement slow-setting, and really made the rotary kiln what it is in our industry.

At or about the same time, I was in Germany at the Dyckerhoff plant and was shown around the establishment by one of their people. While there, either near the plant itself or in an adjacent plant which one of the Dyckerhoff brothers had for the manufacture of concrete pipe and other similar materials, I saw quite a large pile of gypsum, with which I was familiar in handling when Lesley and Trinkle sold a great deal of that type of material. I asked casually about it and remember receiving some equally casual answer, though I believed later on that at that very time the Dyckerhoff people were using gypsum to slow up some of the clinker they were making in vertical and Hoffman kilns. This of course was a mere surmise, but I never got any explanation about it.

*Pioneer in American portland cement manufacture. Author of "History of the Portland Cement Industry in the United States," International Trade Press, Inc., Chicago, 1924.

Lesley himself had been interested in the use of sulfuric acid as a retarder. He writes, further:

I took out a patent in the early 90's for the use of sulphuric acid or other similar acids diluted with water and sprinkled on the clinker or otherwise introduced into the cement clinker, before or after final grinding. In the experiments which were carried on by Booth, Garrett and Blair for me, we obtained remarkable success with a solution of about ¼ to ½% of sulphuric acid, and hydrochloric acid gave almost equally good results. The patent was refused because it was obvious. Thereupon I visited Europe, obtained affidavits from Michaelis, Tetjmayer, Faija and Candlot, and also a statement from Le Chatelier. On the strength of these data, which was to the effect that they had never heard of such a use of sulphuric acid, Blair, of Booth, Garrett & Blair, and I convinced the Patent Office that the process was not obvious, and the patent was granted.

Unfortunately, when it came to be put into practice, the price of raw gypsum was about $2.50 to $3 per ton, while portland cement clinker was worth about $6 to $7 per ton. You can readily see why the patent was not an economical success when the added gypsum at the lower price was sold for portland cement at the higher price, so the patent died aborning.

Another method which was early used for slowing the set was the introduction of dry steam into the tube mills (British patent). This process, writes Lesley, "has been used by the Giant Portland Cement Co. and is used generally by the Associated Portland Cement Manufacturers of England."

Solubility Studies

Candlot[58] was among the first of the investigators to examine the nature of the action of retarding agents. He studied particularly calcium chloride and calcium sulfate.

Dilute solutions of calcium chloride were found to retard the set; concentrated solutions, to accelerate the set. Cements which contained very little aluminate were not affected, whereas those containing large quantities of aluminate were markedly affected by the calcium chloride. Hence, it was argued, the influence of the salt is dependent on its action on the calcium aluminates in the cement. Experiment showed that finely pulverized calcium aluminate ($1.5CaO \cdot Al_2O_3$) entered into solution much more slowly in the calcium chloride solution than in water. The initial set was attributed to the calcium aluminates. Therefore, the delay in the solution of the latter was assigned as the reason for the delay in the time of set in the cement.

With concentrated solutions of calcium chloride the aluminate was found to dissolve more rapidly. If a cement were agitated for a few minutes in a concentrated solution of calcium chloride, and filtered, an abundant deposition of crystals resulted, which were believed by Candlot to be calcium oxychloride. This precipitation is more abundant as the cement is less burned, and is nearly absent in well-burned cement. This was believed to explain the acceleration of set by concentrated calcium chloride solutions.

When calcium sulfate is added to cements, experiments by Candlot indicated that the sulfate and aluminates of lime combine in solution with the formation of a flocculent precipitate of calcium sulfoaluminate crystals. An analysis of these crystals gave the composition:

$$3CaO \cdot Al_2O_3 \cdot 2.5CaSO_4 \cdot aq.$$

The mechanism of the delay in set by the calcium sulfate is given by Candlot as follows:

In the best made portland cements there always exists a little free lime, and as there is present a little alumina, the free lime rapidly dissolving retards the hydration of the aluminate. The calcium sulfate which goes into solution is insufficient to precipitate out the aluminate, and adds its action to that of the lime to annul the role of the aluminate. Since it is this salt that determines the set, we will therefore have a slow set. If the free lime is carbonated by long exposure to the air, then when water is added the solution of lime is less abundant, and does not retard the solution of the aluminate.. Combination with the calcium sulfate can then take place with the formation of calcium sulfoaluminate. Thus the excess of aluminate crystallizing out determines the rapidity of the set.

Meyer[47] expressed nearly the same idea in a very comphensive paper written in 1901. He writes:

As a result of adding gypsum to a cement before gaging, the free lime of the cement retards the hydration of the aluminate because the latter combines with calcium sulfate to form the insoluble calcium sulfoaluminate, and this salt in incapable of causing set. The rapid set of the cement is prevented because the aluminates cannot then crystallize from a supersaturated solution, having already combined with the gypsum.

By calculation, Meyer finds that the quan-

tity of gypsum commonly used (2 to 3%) can combine with only 0.76% Al_2O_3 in the formation of the calcium sulfoaluminate. Since this amount of gypsum satisfactorily retards the set, it is argued that less than 1% of calcium aluminate is present in the "free state" in a normal cement, and that it is this free calcium aluminate which, without the addition of gypsum, would suffice to produce the rapid set. The greater part of the alumina in a normal cement was thought by Meyer to be in the form of a calcium aluminosilicate, which hydrates slowly.

Michaelis[21] maintained that uncombined aluminates are not responsible for the set in well-sintered cements because such cements have all of the alumina in combination as solid solutions in the silicates of lime. This solid solution (the "alite") therefore governs the setting time,

as it is the first acted upon and decomposed by water; the more alite a cement contains and the more alumina this alite contains, the more quick-setting is the cement.

The action of the calcium sulfate in retarding the set is attributed entirely to the formation of a voluminous mass of crystals of the calcium sulfoaluminate, which Michaelis referred to as "Cement Bacilli."

Alkali Action

Rohland[24] attributes all changes in the time of set to the formation of catalysts, which may be either positive or negative. Even the part played by the aluminates in determining the set is explained in that manner.

Hydration really is no function of the aluminates, but they may act as positive catalysts during hydration. Such a statement is supported by the fact that Al_2O_3-rich portland cements hydrate more rapidly than those containing less Al_2O_3.

Likewise, the influence of the degree of fineness of the cement, the kind of storage, the evolution of heat during storage, the light and the moisture content of the air "may assist in the formation of a positive catalyst."

Rohland cites a number of cases where the period of set had changed with time, and where two cements of practically the same ultimate composition had very different times of set.

In explanation, Rohland quotes a sentence from a letter written to him by Le Chatelier: "There are some portland cements manufactured from limestone containing potash, and this potash is in the caustic state and accelerates the set." The potash is believed by Rohland to function as a positive catalyst, but his argument is not altogether clear. In regard to this he states:

They (the potash salts) possibly are in solid solution with the remainder of the cement constituents, the same as is the CaO, and that is the reason, perhaps, why carbonation is so slow sometimes. The influence of these catalysts on the time of hydration may be traced to a variation in the solution pressure of the cement, or the formation of complex ions.

The retarding action of gypsum is then explained as due to a neutralizing of the positive catalytic action of the alkalies, or to a lowering of the solution pressure. The change in set with time is said to be due to a chemical reaction taking place slowly which permits the formation of the positive catalyst, resulting in a shorter time of set, or to secondary reactions between the positive catalyst (alkali) and the carbon dioxide or moisture of the air, resulting in the removal of the active catalyst and consequent extending of the time of set.

The function of the alkalies on the set of cement was studied by Erdahl,[57] who found that the alkali sulfates and silicates had but little accelerating action on the set, whereas the alkali carbonates tended to produce a flash set if present in amounts greater than ½ of 1%.

Grimm[58] reported that all cements contain potassium salts which are converted to the carbonate by the action of moist air, and hence become rapid setting. A sufficient amount of calcium sulfate must then be present to convert all of the potassium carbonate to potassium sulfate and calcium carbonate. This tends to explain the earlier work of Schindler,[59] who found that dry carbon dioxide had but little effect on the time of set of cement, but moist carbon dioxide greatly accelerated it. Others,[60] however, have found practically no difference in the set or hardness of a cement which had been cured in an atmosphere of carbon dioxide or in the absence of carbon dioxide.

Electrolytic Effects

Reibling[61] believed that on solution of the plaster in cement, the ionized calcium sulfate reduced the solubility of other calcium ions present, causing the lime to be less rapidly dissolved, and the aluminate less rapidly hydrated. The slow hydration of the calcium aluminate brought about a retardation of the set.

Klein and Phillips[55] called attention to the observation that had also been made by other investigators that plaster exhibited its greatest retarding action on the set when present in certain rather small amounts (2 or 3%), whereas at lower or higher concentrations the effect was less. This was used as evidence against Riebling's theory for, according to the latter, increasing amounts of plaster should give continuously slower set. Also, according to Klein and Phillips, the formation of calcium sulfoaluminate in the presence of calcium sulfate is only incidental to the initial set and not the cause of its retardation. The amount of these crystals was at all times small, and increasing the amount of plaster, though increasing the amount of calcium sulfoaluminate crystals did not retard the set. Furthermore, they write:

The formation of sulfoaluminate needles is not sufficient to account for the retarding action of salts, such as calcium chloride, sodium borate, potassium bichromate, sugar or other carbohydrates, which, so far as is known, do not form insoluble compounds with aluminates at the concentration used.

Klein and Phillips maintain that:

The problem of the retardation of the setting of cement appears to be one involving the action of electrolytes carrying positive or negative charges.

These authors admit, however, that:

Although the action of electrolytes offers the best explanation so far found, nothing has been definitely proven, and much work must be done on the problem.

In a later paper Bates and Klein[55] observed the setting properties separately of tricalcium aluminate, dicalcium silicate and tricalcium silicate alone and in the presence of gypsum. The tricalcium aluminate was observed to hydrate so rapidly and with the liberation of so much heat "that the mass boils." It was found to agglomerate quickly into balls "which hydrate on the exterior to hard masses which prevent penetration of the water to the interior, consequently large masses of unhydrated material are present." The addition of plaster of paris up to 10% failed to effect any marked difference in the amount of heat evolved or in the other general properties of the aluminate on mixing with water.

Dicalcium silicate, on kneading with water either alone or with plaster, "produced no more plasticity than would have resulted from the substitution of ground quartz of equal fineness for the silicate."

The tricalcium silicate with water "had all the properties of normal portland cement, excepting a slightly inferior plasticity." With 3% of plaster "it even had the plasticity of portland cement, but its initial set was considerably quicker" than without the addition of the plaster.

It will be recalled (Cf. Chap. IV) that Kühl's[25] theory for the setting of cements required the flocculation of a colloidal precipitate of hydrated calcium silicate from a highly dispersed colloidal solution. The coalgulation is stated to be dependent on the concentration of the sol or on the presence of an electrolyte. Kühl continues his discussion of the set by maintaining that the electrolyte solutions which hasten gelatinization are formed (1) by the alkalies which split off during hydration; (2) by the calcium hydroxide liberated, and (3) by the calcium aluminates which are readily soluble. The aluminates are regarded of especial importance because they form trivalent ions and "the ability of ions to form gels and to coagulate them is dependent on the valence."

This action of the aluminate ions is believed by Kühl to explain the action of calcium sulfate on the time of set. Concerning this, he writes:

Formerly we assumed that $CaSO_4$ hindered setting by forming a coating of $CaSO_4$ around the cement grains which protected the grains from the action of water, but such an assumption is absurd because there is no reason why soluble $CaSO_4$ should form an insoluble coating. . . . Then we might assume that cement is less soluble in a saturated $CaSO_4$ solution than in a similar un-

saturated solution, and that the delay in set is due to the consequent insolubility of the cement, but this theory also seems absurd, for by it a small amount of $CaSO_4$ should delay the time of set the same as a larger amount.

To explain this weakness in the theory, Kühl concludes that a saturated solution is not formed quickly enough unless a certain excess of the calcium sulfate is present. Furthermore, a saturated solution alone was found not to be sufficient to retard the set, but some additional calcium sulfate must be present. Hence Kühl concluded that during the set there is a consumption of calcium sulfate, and that a retardation of set is accomplished only when this consumption is again supplied.

Therefore we must assume that $CaSO_4$ forms a double insoluble salt with some ingredient of the cement.

This ingredient he declared to be calcium aluminate, and the insoluble salt to be calcium sulfoaluminate. Kühl concludes his argument in the following paragraph:

The more calcium aluminate that goes into solution, the more $CaSO_4$ is required, and both of these constituents disappear from solution as the insoluble salt. As long as there is a supply of $CaSO_4$ present, which can replace any of the $CaSO_4$ that has combined to form the insoluble salt, then there is no appreciable concentration of tricalcium aluminate formed and accordingly the tricalcium aluminate cannot exert its coagulation effect on the gradually forming colloidal solution of the calcium silicate. Since we have assumed that the set is due to the gelatination of the calcium silicate solution and that this process of gelatination is due to the occurrence of a definite concentration of calcium aluminate, we find an explanation of the action of $CaSO_4$ in the non-formation of the necessary concentration of the tricalcium aluminate. Thus, when $CaSO_4$ is present, setting can occur only after the $CaSO_4$ is used up, or when it is present in very small quantities so that it goes into solution too slowly, . . . or setting may take place in the presence of $CaSO_4$ if the colloidal hydrated calcium silicate solution is so concentrated that gelatination takes place without the influence of dissolved tricalcium aluminate.

Tippmann[62] takes exception to the theory that the set is due to the coagulation of a colloid, and affirms that it is essentially a crystallization process, and that the function of gypsum is to check the crystal formation and at the same time assist in the formation of colloid material. The very fact that a normal cement without the presence of any retarder sets rapidly (flash set) is offered as evidence that the process must be a crystallization from a supersaturated solution, for the formation and coagulation of a colloid would require much greater time.

The experiments made by Tippmann were concerned mainly with the observation of the swelling of various laboratory cement preparations when powdered and placed in water with and without added calcium sulfate. In all cases, cements entirely free of sulfate showed no swelling up to a year; in the presence of sulfate a considerable swelling took place. It was observed further that in the absence of sulfate there was marked crystal formation, while in the presence of sulfate crystal formation was delayed and colloid formation began at once.

Miscellaneous Retarders

Other retarders than the various forms of calcium sulfate have occasionally been suggested and used, but have not become serious competitors of gypsum or plaster. Calcium chloride has been studied recently, for example, by Dautrebande[63] and by Ferrari.[64] According to Dautrebande, a dilute solution of calcium chloride will function to retard the set, but in a concentrated solution, crystalline calcium chloraluminate will be formed and this hastens the set. Ferrari found that calcium chloride retarded the set of calcium silicates, and explained it as due to the extreme rapidity of hydration of CaO in the presence of calcium chloride.

Burchartz[65] claims that sugar delays crystalline formation during hydration, and therefore favors colloidal processes. Hence sugar checks the processes of setting and hardening.

Certain organic substances[66] have been found to form insoluble compounds with the lime of cement, thus retarding the final set, although sometimes accelerating the initial set. This is offered to account for the influence on the set of cement of such organic materials as may be present in the sands used in making the mortars. No evidence was obtained for catalytic action, but the retarding action was believed to be due to a disturbing of the equilibrium.

Various chemicals were employed by Zimmerman,[67] but the results did not permit of general conclusions being drawn.

There recently have been some attempts to determine the relative effectiveness of plaster of paris, gypsum and anhydrite as retarders of the set of portland cement. Berger[68] and Goslich[69] report that plaster of paris is the most effective material, and that anhydrite has practically no effect. On the basis of economy and safety, however, mixtures are recommended, as plaster of paris is said to produce quick setting if used in slight excess. Other investigators,[70] however, have found no essential difference in the effect of the three forms of calcium sulfate.

Summary

It is generally conceded that the alumina-containing compounds present in cements constitute the one important group of substances upon which the rate of set depends. Some authors regard these as solid solutions of one type or another, some as distinct compounds. The most general opinion is that the alumina of cement clinker is in the form of tricalcium aluminate, but this is not an issue in the present case. It is agreed also that the alumina compounds or solid solutions, which we will refer to as calcium aluminate, combine with water with great avidity, and that it is this hydration which causes the initial set. Consequently, the amount of calcium aluminate present, and the rate with which it hydrates, determines the rapidity of set.

The amount of calcium aluminate in the clinker is susceptible of some variation, but in manufacturing technology it appears to be inexpedient to reduce the alumina content of the mixture to a point where slow set will result. It has been found, however, that the introduction of certain materials, notably some form of calcium sulfate, does materially modify the rate of set. Most authors have recognized that the action of the calcium sulfate must in some manner be dependent on an influence which it exerts on the rate of hydration of the calcium aluminate.

The mechanism by which the calcium sulfate determines the hydration of the calcium aluminate has received various explanations. Chief among these may be mentioned the following:

(1) The solubility of the aluminate is decreased in the presence of calcium salts. Hence hydration is retarded.

(2) The dissolved aluminate combines with the calcium sulfate to form crystalline calcium sulfoaluminate. This prevents the normal hydration of the calcium aluminate.

(3) Rapid set, induced by alkali carbonates, is eliminated by neutralizing with calcium sulfate.

(4) The set is caused by precipitation of colloidal silicate, induced by ions, especially, trivalent aluminate ions. Calcium sulfate keeps the ion concentration too low to function as above by precipitation of calcium sulfoaluminate.

(5) The set is caused by precipitation of crystalline substances. Calcium sulfate retards the set by checking crystal formation and aiding in colloid formation.

Retrospect

Opinion on the chemical and structural nature of the processes of setting and hardening of portland cement is decidedly more unified than opinion on the constitution of portland cement clinker. The early views were indeed a medley of inconsistent ideas inadequately supported by experimental evidence. A clear picture of the processes was presented first by LeChatelier. Ideas on the nature of the chemical process have changed only in the less important details in the last quarter century, and the crystallization theory has successfully weathered the attacks of 40 years with only one serious competitor. The colloid theory of Michaelis, with its various modifications, lacks the clarity of form of its more straightforward rival, but has won a deserved recognition. A combination of the two is most generally accepted today, but a close examination of the two theories reveals that much of the difference between

them is superficial rather than real.

The problem of the future lies in obtaining a more exact understanding of the conditions which control the processes, and of the part played by the less abundant constituents of the cement.

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New Cold Water Paint

THE research laboratories of the United States Gypsum Co., Chicago, have developed another product to add to their growing line of structural materials. This time they have developed and placed on the market a cold water paint which they have named "Texolite."

This paint is in the form of a white powder which is mixed with water on the job and can be applied with a brush or spray gun to any clean masonry wall or painted surface that is in good condition. Any color can be obtained with lime proof colors.

New York State Crushed Stone Men Meet at Rochester

(Contributed by President George E. Schaefer)

MEETING in Rochester at the offices of the Dolomite Products Co., the New York State Crushed Stone Association got together for one of its usual good monthly meetings on September 21. John Odenbach of the Dolomite company was the host, assisted by two of his brothers and the other members of his organization, and they left nothing undone in properly and adequately greeting the members and supplying all the needs of the meeting.

The morning session was taken up in an informal general discussion and at one o'clock the assemblage proceeded to the new Odenbach Coffee Shoppe, where dinner was served to the party. This repast was complimentary to the association by the Odenbach brothers, and, needless to say, they again lived up to their reputation as high-class caterers and hosts.

After the luncheon a business meeting was called to order by President Schaefer. Following the usual routine matters, discussion was opened on the still unsettled question of uniform terms of credit. This produced the usual vigorous arguments prevalent at previous gatherings this year, and while no definite action resulted, sentiments seemed to be crystallizing into a mutual satisfactory plan of action proposed for next season. It developed that practically every producer in attendance was now operating on a discount basis of invoicing.

Secretary Owens reported on his trip to Albany the previous week to attend the meeting of State Highway Contractors and Material Producers, and advised of a proposed change in the state lien law advocated for 1929. It was decided that the association immediately investigate this matter to ascertain its possible effect upon the stone producers of the state and that further discussion would develop at next month's meeting.

A communication from National President Graves was then brought to the attention of the meeting, in which he advised of a meeting of the national executive committee and a dinner of the Manufacturers' Division at the Commodore hotel, New York City, on Friday, October 26. President Graves, who was unable to be at the meeting due to a prior engagement in Cleveland, suggested the advisability of the New York State Stone Association meeting in New York City at the same time. A resolution was thereupon offered and unanimously adopted that we hold our October meeting on the 26th at the Commodore hotel, New York City, and every member was urged to co-operate fully in insuring a banner attendance. It was also decided to invite all metropolitan district stone producers to meet with us.

After a vote of thanks to John Odenbach for his hospitality, and action on certain other minor matters, the meeting adjourned and the party drove out to see Mr. Odenbach's new home, constructed entirely of stone and stone products. It was a very interesting trip to all members who had not seen the unique construction. Following this the Dolomite plant west of Rochester was visited, but time and darkness unfortunately prevented any more inspection trips.

Registration

The following crushed stone companies were represented:

General Crushed Stone Co., Easton, Penn.: George E. Schaefer, president of the New York State Crushed Stone Association, John Rice and Mr. MacCone.

Buffalo Crushed Stone Co., Buffalo: A. J. Hooker and James Savage.

Le Roy Lime and Stone Co., Le Roy: J. L. Heimlich and D. Moore.

Dolomite Products Co., Rochester: John, Charles and Mathew Odenbach, H. N. Clark, Walter Sickles, Cassavoi and Harris.

Rock Cut Stone Co., Syracuse: W. L. Sporborg, F. C. Owens and A. G. Seitz.

Wickwire Spencer Steel Co., Inc., Gasport: W. E. Foote.

J. N. Callanan Road Improvement Co., South Bethlehem: B. R. Babcock.

Genesee Stone Products Co.; Mr. Boyce.

The following guests were present: B. H. Norton, E. I. du Pont de Nemours & Co.; Wm. Anderson, Hercules Power Co.

Tractor City Sand and Gravel Co. Buys Madison, Wis., Plant

ANNOUNCEMENT was made recently of the purchase of the J. T. Noel sand plant at Madison, by the Tractor City Sand and Gravel Co. of Janesville, Wis., as a step in the expansion of that company. The new pit will be used to furnish sand to dealers in the Madison territory.

The pit is located in South Madison at the city limits near St. Mary's hospital, and is surrounded by several other pits. It has a capacity of 400 cu. yd. a day. It has been worked for a considerable period of time. Complete new equipment was installed last year and production was greatly increased. Although the new pit is an excellent producer yielding a good grade of sand, it is much smaller than the Janesville pits of the company.

The Tractor City company has taken immediate possession. The personnel of the Madison branch will remain the same. A member of the company, not yet named, will go to Madison and have complete charge of the new pit.—*Janesville* (Wis.) *Gazette*.

Stone Production for 1927

THE production of stone in the United States in 1927, exclusive of stone manufactured into lime, cement and abrasive materials, or crushed into sand, amounted to 136,345,260 short tons, valued at $198,661,622, according to compilation of reports from producers made by the United States Bureau of Mines, Department of Commerce. The figures show an increase of 10% over the 1926 production of 124,496,360 short tons.

Stone sold for curbing, rubble, crushed stone, agricultural limestone, riprap, manufacturing industries and miscellaneous uses increased in quantity and stone sold for construction, monumental stone, paving blocks, flux and refractory decreased.

Building Stone

The building stone sold amounted to 32,104,200 cu. ft.—4% less than in 1926. This includes stone for architectural work and relatively low-priced stone for rough construction, such as foundation, bridges and unshaped face stone for buildings and retaining walls.

More than one-half of the building stone sold was limestone—17,340,690 cu. ft., valued at $18,820,045, this quantity being 6% less than in 1926. The largest quarry center for building limestone, the Bedford-Bloomington district in Indiana, reported total sales from the quarries of 13,572,950 cu. ft. in 1927, valued at $16,407,170, a decrease of 4% in quantity over 1926. Of this total 5,445,970 cu. ft., valued at $3,461,369, was sold as rough stone; 5,268,060 cu. ft., $4,685,844, sawed stone and semi-finished stone; and 2,858,920 cu. ft., $8,259,957, cut stone. The mills of this district not operated in connection with the quarries reported sales of 728,000 cu. ft. of sawed stone, valued at $704,732; 35,030 cu. ft. of semi-finished stone, valued at $58,056, and 907,440 cu. ft. of cut stone, valued at $2,883,657.

Total sales of granite for building stone (6,397,830 cu. ft., valued at $7,672,112) represented nearly one-fifth of the building stone produced in 1927, and decreased 22% in quantity over 1926. The granite sold for architectural work, including rough and dressed stone, was 2,073,550 cu. ft., valued at $6,963,541. The principal states producing granite for architectural building stone were: Massachusetts (574,060 cu. ft.), Maine (417,740 cu. ft.), Minnesota (269,080 cu. ft.), New Hampshire (147,060 cu. ft.), California (110,950 cu. ft.) and Georgia (97,110 cu. ft.). Pennsylvania, Massachusetts and Maryland produced a considerable quantity of granite for rough construction.

Total sales of sandstone for building (3,995,370 cu. ft., valued at $3,025,864), an increase in quantity of 19% from 1926. Sandstone for achitectural work, including rough, sawed and finished stone, amounted to 2,252,200 cu. ft., valued at $2,809,927. Ohio produced 1,636,710 cu. ft.

Marble sold for building stone in 1927 amounted to 2,823,790 cu. ft., valued at $10,739,228, 2% less in quantity than in 1926. The principal states producing building marble are: Tennessee (965,820 cu. ft.), Missouri (526,780 cu. ft.), Vermont (807,110 cu. ft.) and Georgia (187,060 cu. ft.). Alabama, Alaska, Arizona, Arkansas, California, Colorado, Maryland, Massachusetts, New Jersey, New York, North Carolina, Pennsylvania and Utah also furnish marble for building purposes. The product from Georgia and Missouri is chiefly for exterior building and that from Tennessee and Vermont for interior work. Serpentine (100,000 cu. ft., valued at $641,845) quarried in Maryland, Massachusetts, New Jersey, Pennsylvania and Vermont is included in the marble figures. There was also sold 22,930 short tons of serpentine, valued at $94,730. The total sales of marble reported from Carthage, Mo., for 1927 were 350,000 cu. ft., valued at $741,694, a decrease in quantity of 23.8% from 1926.

Basalt showed decreased output for 1927, and various miscellaneous varieties of stone used chiefly for rough construction showed a large increase.

Monumental and Memorial Stone

Stone sold for monumental and memorial work in 1927 amounted to 4,327,270 cu. ft., valued at $14,993,091, a decrease of less than 1% in quantity.

Granite (including rough and dressed stone) reported as sold for this purpose in 1927 was 3,199,790 cu. ft., valued at $10,895,842, a decrease of 1% in quantity. The principal states producing granite for monumental work in 1927 were: Vermont (1,286,170 cu. ft., of which the Barre district produced 1,115,400 cu. ft.), Massachusetts (359,590 cu. ft., of which the Quincy district produced 256,150 cu. ft.), Georgia (236,770 cu. ft.), Minnesota (227,620 cu. ft.), Wisconsin (125,110 cu. ft.), California (103,520 cu. ft.), Rhode Island (103,490 cu. ft.), New Hampshire (98,670 cu. ft.) and Maine (73,800 cu. ft.).

Sales of marble for monumental work (including rough and finished stone) were 1,127,480 cu. ft., valued at $4,097,249.

Street and Road Work and Concrete

Street and road material in general showed increased sales in 1927, although sales of paving blocks (38,705,560 blocks, valued at $3,583,400) decreased 2% in quantity. Stone sold for flagstones (737,680 cu. ft., valued at $573,736) decreased 18%. Stone sold for curbing (4,862,580 cu. ft., valued at $4,939,716) increased 10% in quantity. Total crushed stone amounted to 94,948,770 short tons, valued at $97,474,267 in 1927, an increase of 15% in quantity. Crushed stone for concrete and road work (78,544,210 tons, valued at $84,177,237) increased 17% in quantity, and crushed stone reported as used for railroad ballast (16,404,560 tons, valued at $13,297,030) increased 5%.

Fluxing Stone

Stone sold for fluxing to blast furnaces, open hearth steel works, smelters and other metallurgical plants amounted to 21,666,070 short tons, valued at $15,985,525, a decrease of 9% in quantity.

Refractory Stone

Stone reported for refractory use, which includes dolomite, quartzite and mica schist, amounted to 1,362,920 short tons, valued at $1,710,708, in 1927, a decrease in quantity of 11%. Raw dolomite reported as sold for the manufacture of refractories in 1927 amounted to 434,160 short tons, valued at $424,140. Besides this quantity, operators who both quarry and dead-burn or sinter dolomite reported 374,415 tons of sintered material, valued at $3,459,803. The quantity of raw dolomite reported was 15% less than in 1926, and the sintered material decreased 3%. Quartzite (ganister) used in the manufacture of refractory brick, for furnace lining and for the manufacture of ferrosilicon amounted to 900,720 short tons, valued at $1,164,768. This was a decrease of 9% in quantity. Sales of mica schist for furnace and kiln lining, which is quarried in Montgomery county, Pennsylvania, near Edge Hill, amounted to 28,040 tons, valued at $121,800, a decrease in quantity of 21%.

Sales in 1927 of pulverized limestone for agricultural use amounted to 2,206,470 tons, valued at $3,360,704, an increase of 19% in quantity over the sales for 1926.

The accompanying table shows the sales of stone in 1927 by uses and the sales for 1926 for comparison.

STONE SOLD OR USED BY PRODUCERS IN THE UNITED STATES, 1926 AND 1927, BY USES

Use	1926 Quantity	1926 Value	1927 Quantity	1927 Value
Building stone, cubic feet	33,467,420	$39,922,851	32,104,200	$40,595,127
Short tons—approximate	2,609,190		2,485,120	
Monumental stone, cubic feet	4,335,770	14,580,929	4,327,270	14,993,091
Short tons—approximate	359,950		358,130	
Paving blocks, number	39,563,180	3,399,602	38,705,560	3,583,400
Short tons—approximate	366,370		366,740	
Curbing, cubic feet	4,409,930	4,303,280	4,862,580	4,939,716
Short tons—approximate	346,020		378,230	
Flagging, cubic feet	902,424	657,435	737,680	573,736
Short tons—approximate	66,330		55,160	
Rubble, short tons	539,670	917,433	809,020	998,108
Riprap, short tons	4,060,280	4,652,717	4,618,500	4,716,731
Crushed stone, short tons	82,515,560	87,872,014	94,948,770	97,474,267
Furnace flux (limestone and marble), short tons	23,859,390	18,049,012	21,666,070	15,985,525
Refractory stone (ganister, mica, schist and dolomite), short tons	1,531,070	1,925,832	1,362,920	1,710,708
Agricultural limestone, short tons	1,850,620	3,064,235	2,206,470	3,360,704
Manufacturing industries (limestone and marble), short tons	4,953,800	4,376,026	5,352,130	4,735,114
Other uses	1,438,110	4,587,224	1,738,000	4,995,395
Total (quantities approximate in short tons)	124,496,360	$188,308,590	136,345,260	$198,661,622

Book Reviews

History of the Portland Cement Industry in Germany

Reviewed by P. H. BATES

THE GERMAN CEMENT INDUSTRY (DIE DEUTSCHE ZEMENT INDUSTRIE). By Dr. Ing. Riepert, assisted by Drs. Quietmeyer, Schott and Haegermann. 1099 pages, 682 illustrations and 2 folding maps. Published by Zementverlag, Charlottenburg, Germany, 1927. Review, P. H. Bates, U. S. Bureau of Standards, Washington, D. C.

THE approach of the fiftieth anniversary of the German Portland Cement Manufacturers Association, celebrated in August of 1927, was the chief incentive which induced Dr. Riepert and his collaborators to prepare this large and most interesting history of the portland cement industry in Germany. To make the volume more complete they have not confined their attention alone to the development of the industry, commercially and technically, but included a sketch of the early uses of inorganic cementing materials—gypsum, lime, hydraulic lime, lime-puzzuolana and other materials, and the natural sequences of development which ultimately lead to the making of portland cement. Finally, to thoroughly round out the volume, they have cited many of the notable uses of cement in their country.

The work is divided into three parts. Part I, of 396 pages, is divided into four sections. The first of these, on "Mortars from their first use to the time of the manufacture of portland cement," was prepared by Dr. F. Quietmeyer. The second section, on "The development of cement manufacture in Germany," and part of the third section, on "The development of our knowledge of cement," were written by Dr. F. Schott. The remainder of the third section was prepared by Dr. G. Haegermann, on "The development of cement testing in Germany." Section four, by Dr. Riepert, is given over to a brief account of the history of each cement plant in Germany. Part II, comprising 435 pages and devoted to the making and using of concrete, and Part III, covering 147 pages devoted to the economical developments and combinations, were prepared by Dr. Riepert.

All the phases of the subject are presented in all the thoroughness which characterizes the German when he assigns himself the task of doing a careful, complete, painstaking piece of work. While of necessity according to the title it is given over to the cement industry as it unfolded itself in Germany, the authors have never failed to cite facts and conditions from outside their country when such better illustrated the thoughts they were presenting. In the second line of the text we have cited the books of Deuteronomy, Psalms, and Ezekiel as giving extremely early references to the use of plasters or mortars. The last of a total of 682 illustrations is a chart illustrating the relative growth of production in the United States and Germany.

Dr. Quietmeyer's section is entirely historical. Starting with the above-mentioned biblical references, he cites Cato the Elder, Pliny, Vitruvius and others, giving us about all that is known about hydraulic binding agents from the earliest times to the end of the Western Roman Empire. Then we have a portion given over to what little is available in the period from the fall of Rome to the middle of the 18th century. During the next century development was more rapid and it is necessary to divide a portion between continental Europe and England. Then on the threshold of the actual appearance of portland cement we find chapters devoted to still shorter periods as the work of such as Bergman, Smeaton, Parker, John, Vicat, Fuchs, Dobbs, St. Legers, Tickell, Frost, the Aspdins (father and son), Pasley, and others is unfolded to us. The abstracts of the patents given Dobbs, Tickell and Frost in England and St. Leger in France, all of which antedate those of Aspdin, would seem to indicate as much of a muddling in the patent situation then as now and further indicate that the acceptance of Aspdin having first patented portland cement is due more to his having named it and successfully continuously manufactured it.

Dr. Schott's first contribution on the development of manufacture is presented in excellent sequence with respect to the kind of cement made and the types of equipment used. Such matters are of interest historically and as such we should have a record of them, though to the producer they are of little practical use. His second contribution to the volume, on the growth of the knowledge of cement, is of more value to all interested in cement, although again it must be considered largely as an historical record. But its great value lies in the presentation in a brief form the scientific papers and finding of the German Cement Manufacturers Association, year by year, since the origin of the association. One is brought almost into a personal contact with their meetings by having come into view, as the pages of this portion are turned over, the portraits of such well known authorities, now mostly "passed on," as Michaelis, Dycherhoff, Gary, Schott, Framm and others.

Dr. Haegermann's contribution on the development of testing is of value to a great many, since it covers not only test methods but also the development of specifications. The first specification cited is that of Grant of 1875; in this a tensile strength of a 1:1½ mortar at seven days of 400 lb. per sq. in. is demanded. From then on we have given the various standards as they were brought forward in Germany, the first being that of 1878. But in addition to the actual standards we have resumes of the discussion and the data which lead up to their adoption. Finally we have the standards for eisen-portland (35% slag and 65% portland clinker) and hochofen cement (65% slag and 35% clinker). Apparently in Germany the word cement does not signify portland cement only.

The section given over to a short history of each plant in Germany is another piece of valuable historical record, but which to American readers will not generally be of interest. A similar record covering the same field in this country should be of value to a large public here.

The second part of 435 pages of the volume is divided into two sections, a short one of 43 pages on the design of concrete mixes and a larger one on the application of concrete. The subject matter in the former is presented along orthodox lines and therefore has little of special interest. The latter portion should be of value to all interested in concrete and not familiar with its use abroad as represented by Germany. This part is profusely illustrated with excellent views of concrete in all of its many applications. Although it makes no attempt to go into the fundamentals of concrete structure design, this in no way detracts from the value it would be to anyone interested in the use of concrete. A study of the illustrations indicates among other things a difference in the appearance of the German structures as compared with ours which in many cases creates a more favorable impression for the former. This, however, surely does not apply to the several churches illustrated. A striking feature is the apparent slenderness of the sections of beams, girders and columns. Some of the structures would appear almost fragile to one accustomed to the massiveness of American reinforced concrete structures. About 100 pages of the section are given over to such cement products as tile, block, pipe, etc.

The third section, devoted to the economical development and commercial combinations (which in the United States would quite likely be labeled "for the restraint of trade") should furnish most entertaining reading for our plant owners, executives and others interested not only in making cement but also dividends. This part is indeed a discussion of the growth of the industry in Germany, internal and foreign competition, disappearing profits accompanied with an increasing number of plants, price fluctuation, and the history of the gradual developments that led to certain combinations of producing interests, approved by the Government, until there

resulted the present three "Zement-Bundes," one of each covering, roughly, northern, southern and western Germany. How envious such a legal division must render some of our domestic producers!

The reviewer is not in a position to say anything regarding the accuracy of the matter presented, although he was not able to find anything concerning cement, mortars or plasters in one of the biblical references. However, the caliber of the authors indicates that errors must be a minimum in number. He does feel that the volume should be in the hands of all deeply interested in the past and future of cement not only in Germany but anywhere.

French Book on Cements

Reviewed by E. S. AND W. S. ERNST

LE CIMENT PORTLAND — CIMENTS PORTLAND ARTIFICIELS — CIMENTS DE LATIER — CIMENTS ALUMINEUX — CIMENTS A HAUTES RESISTANCES. Materiers Premieres; Material de Fabrication et Ensembles d'Usines. By E. C. Blanc, engineer, in collaboration with E. C. Eckel, consulting engineer, member A. S. C. E. and Geological Society of America.

THE author of this volume is not unknown to American readers interested in the manufacture of portland cement. He has made numerous valuable contributions to the literature of the industry which have appeared from time to time in the industrial magazines. It has been his purpose in preparing the present work to make a more or less complete survey of the manufacture of portland cement and to deal with a few of its problems. In this he has succeeded admirably. By itself, it must be recognized as being a clearly written treatment of its subject matter and one well worth the time spent in reading it.

The author has seen fit to take up his subject under the following headings in the order named (free translation):

Raw materials, their composition and origin; Methods employed in extracting the raw materials together with the machinery employed; Crushing; Preparation of mixtures (both dry and wet process); Cement burning—shaft kilns; Cement burning—rotary kilns; Thermochemistry of the process; Combustibles and their preparation; Storing and grinding of clinker; Storing and conveying of the finished cement; Production and distribution of power; Control of manufacture, and cost of production; Description of plants; Constitution and properties of portland cement; Puzzolanic cements; Super and high-alumina cements; Bibliography.

The above indicates in a rather sketchy way the scope of the book. Each step is taken up in detail and clearly discussed by the aid of many appropriate illustrations, tables and charts. Much of the work is given over to the description of processes and machinery in use in this country and in Europe, comparisons being made in some instances. Many readers, no doubt, would prefer that the author had placed a bit more emphasis on this phase of his treatment of the subject in order that it might have better served as an aid to the choice of methods, machinery, etc., best suited to a given set of conditions.

Due to the paucity of real comparative information available, however, it is a rather difficult thing to do this at this stage of the industry. Too often personal preferences and prejudices, rather than cold statistical data, have been the deciding factors in the choice of the equipment used, so that it is often hard to say definitely just how certain methods and machinery would perform under specific conditions in comparison with other methods and machinery. The fault lies with the manner in which the industry has advanced rather than in the author's desire to be of service, however, for the development of the former has taken place in the past largely under "rule of thumb" conditions and those that local environment have imposed.

The section relating to shaft kilns and their operation is especially interesting. Here, in the United States, the high cost of labor limits their use by offsetting to a great extent the advantages gained by their acknowledged high fuel economy. In Europe, on the other hand, conditions are quite different and are favorable to their use. It is only natural, then, that they have been developed there.

It appears to the writers that in the light of the findings of recent investigations into the constitution of portland cement an undue emphasis has been placed on the proportioning formulae which were brought forward in the early days of the present century. Without a doubt they have served a useful purpose, and in a way perform the function for which they were designed, but they do not tell the whole story. They would indicate that portland cement clinker is composed of tricalcium silicate and dicalcium aluminate; while the more recent formulae, resulting from research performed under the most exacting conditions with the most modern equipment, are based on the idea that it is made up of tricalcium silicate, dicalcium silicate, tricalcium aluminate and small amounts of several minor constituents. It seems, while the results obtained and the conclusions drawn by modern investigators are mentioned, that they are not given the place they deserve in the book.

The section comparing the different specifications in use in various countries deserves attention also, as does the discussion of the manufacture and uses of the special cements produced there.

While fulfilling the stated purposes of the book, as it does in a clear and well-written manner, the average American reader, unfamiliar with the French language, will find little in it that has not already been written in English and published in similar volumes in this country to warrant a tedious translation. Those conversant with the language, however, will find it clearly and well written and filled with useful information.

Rocks and Rock Minerals

A SECOND edition of Rocks and Rock Minerals, by Louis V. Pirsson, revised by Adolph Knopf, has been published. It fills the need for a simple and sufficiently complete manual for the study of ordinary rocks without the use of a microscope. It is granted that modern petrology rests on microscopic work, but the methods of microscopic determination require too expensive apparatus and need too much training for the ordinary man to use. For such purposes as those of the ordinary engineer and quarryman, the methods given in this book are quite sufficient.

The book reads easily; the reader is not bothered by many unfamiliar terms, and such of these as are used are defined. It is well illustrated. John Wiley and Sons, New York City, are the publishers.

Architectural Design in Concrete

THE rapid advances in concrete as a building material has forced architects in practically every country into a new school of architecture. In the earlier days, lack of knowledge concerning the strength of materials tended to produce close spacing of heavy columns, and a considerable amount of encumbrances which has disappeared in modern concrete structures.

All this has been taken into consideration in a new book, "Architectural Design in Concrete," by T. P. Bennett, which contains interesting data on architecture from the early Egyptian, Greek and Roman to the modern European and American types. Not only is the text apt and well written, but there are also 100 full plates depicting concrete construction, both exterior and interior.

The sum and substance of the new concrete period is best expressed by the following quotations from the new book:

"It is possible that the day of the Renaissance is passing and that a period of more original design is at hand. It may be that the advent of new developments in steel and concrete were needed to provide an impetus of sufficient importance for the designer to cast off the restrictions imposed by tradition and to produce new forms and new compositions which would arise naturally from the whole of the conditions governing the production of building.

"The immense importance of this movement it is impossible to overestimate: it represents a new and a live attitude towards design; it represents an amount of originality of thought which has not been called into being at any period since the Greeks evolved a perfect architecture of masonry and the Romans evolved an ability to solve constructional problems which to them were of unprecedented magnitude."

The book may be classed as the first comprehensive and authoritative volume of its sort to deal with such an important subject. The publishers are the Oxford University Press, American Branch, New York City.

Hints and Helps for Superintendents

Inexpensive Stucco Sign

AN inexpensive and pleasing sign which will stand the ravages of time and weather without losing its color can be made the use of two colors of stucco and a little time. The flat surface on which the sign is to appear (as the side of a building) is first given a good coat of one color stucco and allowed sufficient time to dry thoroughly. Then a second coat of the other color is applied and the shaps of the desired letters

Sign made of two shades of stucco shows up well on plant office building

are marked on this coat while it is still wet. Then the wet stucco within the outlines of the letters is wiped away, leaving the color of the original coat of stucco. The simplest way to mark the letters on the wet stucco is to have the shapes cut out of stiff paper or cardboard before the work is started, and placing each letter in its correct position mark around its edges.

The illustration shows the use of a sign of this kind on the office of the Rib-Stone Concrete Corp. at Le Roy, N. Y. The cost of the sign shown was about $12, while a similar sign equal to it in appearance would have cost many times that if purchased at a sign painter's establishment.

Care of Anti-Friction Bearings

THAT the ball or roller bearing is not a panacea for all bearing trouble was admitted in a paper on "Anti-Friction Bearings for Electric Motors," by J. S. Murray, electrical engineer, Follansbee Brothers Co., Follansbee, W. Va., at the recent Chicago meeting of the Association of Iron and Steel Electrical Engineers. "Properly selected and applied, however, they offer a definite and tangible return on investment. Improper application, except in rare cases, results in unsatisfactory service and high maintenance costs. The fundamentals of anti-friction bearing practice must be understood to obtain its most satisfactory performance.

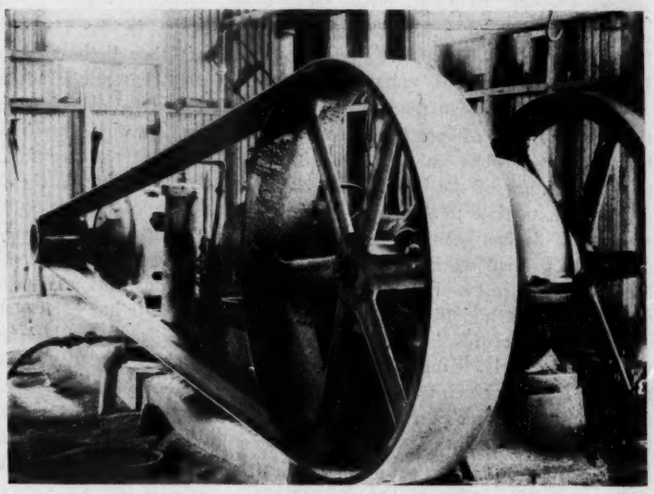
"Due to the comparatively small width of anti-friction bearings, the projected area between the bore of the inner race ring and the outside diameter of the shaft leads to high values of pressure under usual operating loads. This pressure will amount to from 500 to 1000 lb. per sq. in. This intensity of pressure requires a positive means for securing the two together, to prevent relative rotation. If clearance exists between these parts there will be a rotation similar to that of a spur gear meshing with an internal gear of slightly larger pitch diameter. This creeping under high pressures will develop destructive wear of shaft with heating. To overcome this it is necessary to have a press fit of inner race on the shaft, and whenever possible secure the race against a shaft shoulder by an adequate locking device.

Ample Lubrication Essential

"Today there are few motors built which do not provide for ample lubrication space to allow for enough grease or oil to insure operation over a long period of time without renewal. There is little wearing out of the lubricant, since it has only two functions to perform. The first is to lubricate the parts of the retainer in contact with the balls or rollers and the second to keep the highly polished surfaces from corrosion. As a result only a small quantity of oil or grease is required, and consequently the lubrication problem is greatly reduced. Several manufacturers now make a neutral mineral lubricant which is desirable for anti-friction bearings. At intervals of from one to two years the old grease or oil should be replaced with new lubricant. The only precautions which need be taken are to keep the lubricant clean and not to use too much of it.

"Where there is a long overhang of the shaft beyond the bearing, or where the load to be carried is large, it is usual practice to mount a roller bearing at the drive end of the shaft with ball bearing at the opposite end for thrust. This arrangement obviously eliminates difficulties due to expansion of the shaft, as the rollers of the roller bearing may move laterally across the face of the outer ring.

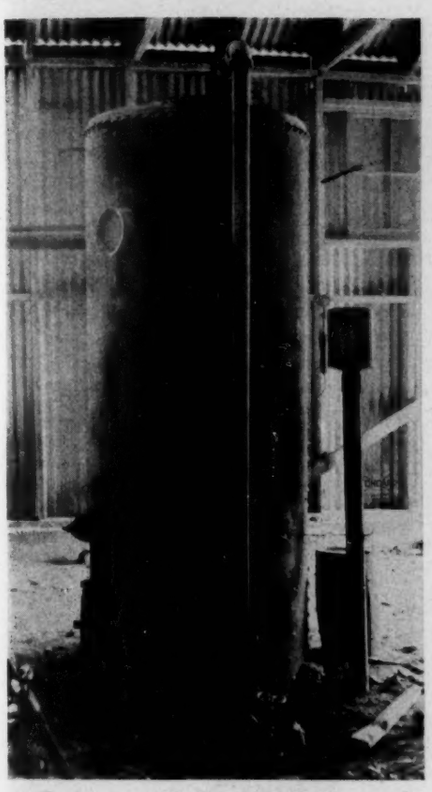
"On very large motors subjected to heavy radial loading with comparatively light end thrust, a combination of two roller bearings is employed. The roller bearing at the closed end of the motor is of the self-contained type, locating the armature endwise, while the drive-end bearing is of the separable type. Some manufacturers prefer to use the self-contained roller bearing at each end of the shaft, in which case the drive-end bearing is allowed to float endwise."



Old steam-driven compressor which had its steam piston changed for a smaller air piston

Three Compressor Kinks in the Same Room

IN visiting the numerous plants in various sections of the country it is sometimes difficult to locate little kinks that would be of interest and helpful to readers. All plants have some ingenious pieces of equipment that the local operators have become used to and which are therefore merely taken for granted. As they say, "It don't amount to much." So it was rather unusual to find three items of interest all in the little compressor room of the Illinois Electric Limestone Co. plant at Falling Springs, Ill., on a recent trip to that operation.



An old vertical fire type boiler used as an air receiver

The first "kink" was an adaption of an old vertical type fire tube boiler as an air receiver. Second, there was about 10 ft. away an old Gardner, direct-steam-driven type compressor which had undergone an operation, having had its steam piston removed and a shorter air piston rod installed, thereby converting the machine into a single acting air compressor. The machine was then belted to a 40-hp. motor. The third kink, while a patented article, is still unusual enough to be noted. This was the installation of a "Protectometer" on the air intake line to the compressor. Many operators would hesitate to spend the money necessary to buy an air filter for a new compressor, but Walter La Pere, master mechanic, believes if a compressor is worth running it is worth giving the best of air even if it is "an old timer."

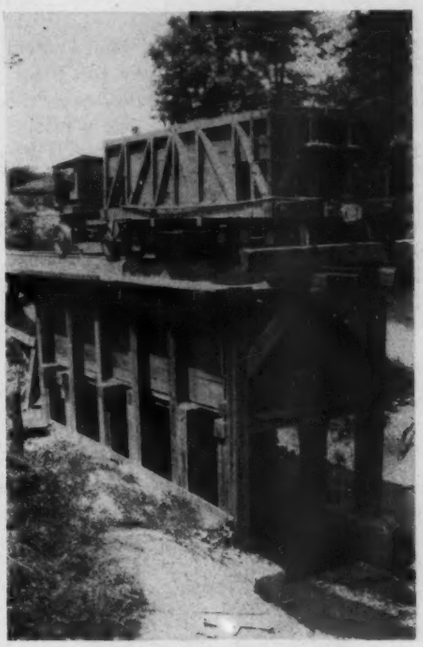
Concreting Churn Drill Hole for More Effective Blasting

EXPLOSIVES are extremely expensive at the plant of the Dalmatian Portland Cement Works Co., Ltd., near Spalato, Dalmatia, in Yugoslavia. Consequently every effort is made in the open-cut-mining operations to minimize the quantity used per ton of rock broken. One measure to this end is to bottom the 6-in. churn-drill holes about 20 ft. above the horizon to which it is planned to break. Whether this will prove satisfactory in the long run remains to be seen. A more certain measure for economy is the careful loading of the holes and the final closing of the collar with concrete to a depth of from 5 to 7 ft.

Mining operations are efficiently organized and modern methods are in vogue. The bench is from 120 to 150 ft. high. Churn-drill holes are placed from 15 to 25 ft. back from the vertical face, and are spaced about 16 ft. apart. Recently one blast was fired that broke nearly 75,000 tons of material from a face 250 ft. long and 125 ft. high. The following shows the manner of loading a typical 6-in. drill hole: beginning from the bottom, 10 ft. of gelatine blasting dynamite from Switzerland, used because of the water present in most of the holes; 20 ft. of Titanit, an explosive consisting of nitrate of ammonia and TNT, made in Yugoslavia; 10 ft. of tamping material; 12 ft. of Titanit; 6 ft. of tamping; 8 ft. of Titanit; 6 ft. of tamping; 5 ft. of Titanit; 6 ft. of tamping; 7 ft. of Titanit; 5 ft. of tamping; 6 ft. of concrete, poured into the hole and allowed to set. Cordeau safety detonating fuse was used to fire the entire set of 16 holes simultaneously. The charge for the entire blast consisted of 2860 kg. of Titanit and 843 kg. of gelatine dynamite, or 3703 kg. of explosive. The managers of the company believe that the sealing of the holes with concrete added to the effectiveness of the explosion and permitted lighter charging than otherwise would have been needed.—*Engineering and Mining Journal.*

Auxiliary Hopper for Truck Loading at a Sand Plant

AT the plant of the Kenosha Sand and Gravel Co. at Silver Lake, Wis., there is quite a steep grade from the concrete road up to the plant. To provide means of shipping by truck without making it necessary to negotiate this grade, and also to keep the trucks away from the plant, an auxiliary hopper has been built at some distance from the plant and just beside the road. This hopper is filled by a 20-yd. bottom-dump car operating on a standard gage railroad track. This car is hauled to and from the plant by an old Nash "Quad" truck stripped down to the chassis and fitted with flanged railroad type wheels. The truck had served its day and would have been junked if this use had not presented itself. The arrangement is inexpensive and saves both time and maintenance cost on the trucks, since it is necessary for them to be off the hard road only just as they drive under the hopper. Moreover, it saves the maintenance cost of roads near the plant and keeps the trucks from interfering with car shipping at the plant. The old truck is also a happy idea.



Arrangement of hopper beside the main highway for loading direct to trucks

Remodeled truck above auxiliary hopper for loading directly to trucks so they need not come to the plant

Duluth Plant Has Picnic With Trophy Dedication as Feature

The Second Award in Three Years

DEDICATION of the Portland Cement Association safety trophy for a perfect safety record during 1927 was the outstanding feature at the big picnic at the Duluth plant of the Universal Portland Cement Company on Wednesday afternoon, August 22. Several hundred workers with the members of their families, as well as city officials and other invited guests and persons of prominence in the cement industry, attended. The

Ray S. Huey

safety trophy, originally won by the Duluth plant for operating throughout the year 1925 without accident, was reinscribed and rededicated in honor of the similar achievement of the mill last year.

Carl D. Franks of Chicago, manager of midwestern offices of the Portland Cement Association, represented the organization which made the award and, in an address pointing to the excellent work along accident prevention lines accomplished by the winners, took occasion to refer to the many resulting benefits. Mr. Franks declared that the prevention of personal injury to workers not only lessened pain, misery and financial misfortune to the injured worker and his family, but that it reduced waste of many kinds, lowered production costs, made employment in the cement mills more attractive and preserved the full buying power which is represented by an undepleted payroll. This latter fact, Mr. Franks pointed out, made accident prevention in the Duluth mill of interest to everyone anxious to protect the general prosperity of the community.

Superintendent Ray S. Huey, who has been in general charge of the Duluth plant since it was opened in 1916, accepted the rededicated trophy on behalf of the 400 workmen and pledged continued efforts to avoid accidents and maintain operations at highest efficiency.

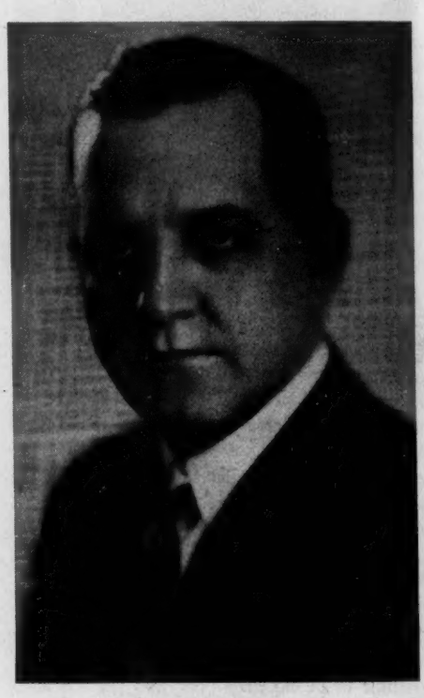
Mayor S. F. Snively of Duluth made a short address emphasizing the pride with which the city viewed the humanitarian work of its local cement mill, and William A. McGonagle, representing Duluth commercial interests, also spoke. Among the general officials of the company present was George A. Davis of Chicago, manager of the department of safety and relief for all Universal mills. Gordon S. Huth, employment and safety manager of the Duluth plant, was the recipient of many congratulations, as were A. E. Miller and W. E. Bellingham, chair-

Gordon S. Huth

men respectively of the 1927 and 1928 safety committees.

At the conclusion of the formal ceremonies a full program of sports and athletic competitions was staged. The baseball game was one of the best organized features and attracted the greatest interest. By a hard-earned score of 13 to 10 the mill team defeated the office team. The mill aggregation included C. Anderson, F. Beatty, Frank Benassi, Nick Coppra, E. Fechner, B. Green, L. Hubert, G. Krueger, William Ramsey and D. Robinson. The office outfit consisted of E. Aman, H. Anderson, A. Cyr, C. J. Furlong, Earl Lowe, Harry Lundgren, C. Lutzke, A. Rogers, A. Shay and E. Staley. John Myrhman acted as umpire.

The horseshoe pitching contest was in charge of W. E. Bellingham; croquet contest for women, J. D. Ritchie; other events were all under the competent management of carefully selected mill devotees. Superintendent Huey managed the peanut rolling race for women with both skill and tact.



Carl D. Franks

The affair was highly successful in all particulars, and although the Duluth mill is out of the 1928 trophy contest because of an unfortunate yard accident in January, plans are already taking shape to capture the association prize again in 1929.

Employes, officials and guests at the rededication of the safety trophy at the Duluth plant of the Universal Portland Cement Co.

Some Observations Regarding the Health of Cement Workers

A Discussion of the Problems of Personal Health of Workmen in So-Called "Dusty" Industries

By A. J. R. Curtis
Assistant to General Manager, Portland Cement Association

MUCH attention has been given during the last dozen years to the protection of workmen in the various industries against diseases to which their occupations might predispose them. Many studies have been conducted by employers, either from humanitarian or economic motives, while a great deal of valuable work of this kind has been done by public and semi-public agencies. Several studies have been made at various times on the health of cement workers but most of these have furnished only fragmentary information.

Investigators have frequently attributed various illnesses suffered by cement workers to the effect of cement mill dust, and have as frequently overlooked the probable effect of exposure to weather. A considerable proportion of the men engaged in operating cement mills and quarries are exposed occasionally to severe weather hazards and to dry atmosphere at high temperatures within the mill while there is cold, wet weather without.

One of the most interesting studies of the health of cement workers which has come to light recently is that made by the United States Public Health Service, from data obtained in an eastern cement plant several years ago. The study is one of a series covering workers in dusty trades, the cement plant experience being taken as a record of health performances of a group of workers exposed to calcium dust. It is proposed to investigate also the effect of granite and various other dusts on groups of workers exposed to them.

Records were kept for three years of all absentees from work and the nature of the disabling sickness (if any) was ascertained. In such cases a nurse visited the home and the actual physical condition was determined as nearly as possible. Physical examinations were made, X-ray films taken where considered necessary, and the duration of the disability and other data were carefully recorded. The quantity and character of the dust in the atmosphere in different parts of the plant, and in the community, was carefully determined.

Of necessity the study had to be limited to one mill and as there is no such thing as a "typical" cement mill or mill environment, the results cannot be considered typical from a quantitative point of view. In fact, the investigators state frankly that they were in search of as dusty a plant as might be found, in order that any harmful effects of dusty atmosphere might be more apparent. Since this study was made the plant visited has been so completely overhauled and, in fact, mill operating conditions have changed so radically almost everywhere that it is doubted whether the counterpart of plant conditions prevailing while these observations were being made could be found in the industry today.

AS the number of accidents in the cement industry decreases because of the intensive safety campaigns being carried on in the field, it is natural that interest in health matters should increase. Little has been written on this subject in recent years, and so the present article should be welcomed by safety workers throughout the whole industry. The author has taken pains to prepare this article very carefully, and has had the benefit of constructive criticism from a number of leading surgeons.—The Editor.

As no practical way was found to separate illness caused by exposure to weather, alcoholism and other excesses, etc., from those which might be due wholly or in part to the presence of the dust, it is not unlikely that cases have been charged to dust in which this factor was at best only a minor cause.

Exposure to weather, for example, would naturally be expected to cause a tendency to la grippe, bronchitis and colds, leading to absences of a few days, quite irrespective of dust present in the atmosphere. How much the presence of calcium dust in the atmosphere contributes to the abnormal number of light disorders of that class found by the U. S. Public Health Service in its study is still left a matter of speculation. From this study, however, it seems not improbable that the presence of the dust in sufficient quantities may irritate and possibly prolong colds or bronchitis of other origin.

Some of the high points of the study are discussed in the following paragraphs.

Tuberculosis and Pneumonia

Calcium dusts produced in the process of manufacturing portland cement do not predispose the workers to tuberculosis or pneumonia. As the analyses of the dusts encountered at the plant studied were practically the same as those found around cement mills generally (although the volume of dust there is believed to have been greater than encountered around any mill in operation at present) the above conclusion, made with reference to conditions in the mill studied, may be assumed to apply equally to cement mills in general.

In the physical examination of the employes of the cement mill studied, all cases suspected were subjected to a special chest examination in minute detail. Numerous cases of arrested pulmonary tuberculosis were found, while the single case of active tuberculosis which terminated fatally was found to have been of long standing—before the victim's employment in the cement industry.

Of a total of 570 men examined, suspected or positive cases of tuberculosis totaled 21, the examination data being briefly summed up as follows:

Case 1. Age, 51 years. Repairman and foreman, kiln room, 16 years. Previously riveter in boiler shop, 6 years. Fibrosis in both lungs; chronic bronchitis in base of left lung. Inactive pulmonary tuberculosis, which probably existed prior to employment in the cement industry.

Case 2. Age, 36 years. Griffin miller, finishing mill, 12 years. Previously packer, cement mill, 5 years. Latent tuberculosis suspected in the apices of both lungs, but suspicious areas may not be tuberculosis, inasmuch as employe is syphilitic.

Case 3. Age, 44 years. Miller, coal mill, 7 years. Previously: various jobs, cement mill, 3 years. Chronic fibroid tuberculosis in right lung with possible extension into the left upper. Disease terminated fatally 1 year after study closed. Employe stopped work only a few days before his death.

Case 4. Age, 42 years. Cement plant executive, 7 years. Previously master mechanic, 15 years. Inactive pulmonary tuberculosis.

Case 5. Age, 32 years. Craneman, quarry, 5 years. Previously a farmer, 10 years. There is evidence by both X-ray and physical examination of a quiescent tuberculosis lesion in right apex.

Case 6. Age, 24 years. Bag sorter, 4 years. Previously a farmer, 5 years. Suspected early pulmonary tuberculosis.

Case 7. Age, 30 years. Floor man and bag sorter, bag room, 4 years. Previously a clerk, grocery store. Physical examinations and X-ray indicate a small inactive tuberculous process in the right apex of several years' duration.

Case 8. Age, 28 years. Repairman, quarry, 3 years. Previously a truck driver, 3 years. Inactive pulmonary tuberculosis, which possibly existed before his work in the cement industry.

Case 9. Age, 33 years. Blasksmith, mechanical department, 3 years. Previously a repairman, cement mill, 1 year. Fibrosis in both apices, more in left than in right lung, possibly due to an old healed tuberculous process.

Case 10. Age, 30 years. Repair helper, kiln room, 3 years. Previously a miller, raw mill, and other occupations in cement plant, 6 years. Picture is indicative of tuberculous condition in right apex, with extension of the disease to the left apex. It is perhaps quiescent or arrested.

Case 11. Age 39 years. Yard laborer, cement mill, 3 years. Previously a laborer, other plants, 24 years. Fibrosis in apices; may be due to an old tuberculous infection which has healed by fibrosis.

Case 12. Age, 40 years. Yard laborer, cement mill, 2½ years. Previously a machinest, 1½ years. Tuberculous lesion in both apices, but employe's clinical condition suggests inactivity at present.

Case 13. Age, 42 years. Dryer fireman, stone house, 2 years. Previously a fireman, boiler house, 10 years. Fibrosis in right apex, the result of an old tuberculous process. Evidence of chronic bronchitis in bases of both lungs.

Case 14. Age, 35 years. Blacksmith's helper, quarry, 7 months. Previously in construction work, cement plant, 1½ years. Arrested pulmonary tuberculosis. The disease possibly existed prior to his work in the cement industry.

Case 15. Age, 30 years. Car cleaner, packing department, 6 months. Previously a yard laborer, cement plant, 2 years. Physical examination and X-ray show evidences of an old tuberculous process in the apices of both lungs. Disease apparently arrested.

Case 16. Age, 34 years. Yard laborer, 4 months. Previously a day laborer (sewer), 2 years. Evidence of an old fibrosed lesion in the right apex; no evidence of active pulmonary disease.

Case 17. Age, 41 years. Construction man, mechanical department, 4 months. Previously a yard laborer, cement plant, 7 months. Fibrosis in apices; no evidence of active pulmonary disease at present.

Case 18. Age, 30 years. Scale man, stone house, 2 months. Previously a fireman, boiler house, 7 years. Early pulmonary tuberculosis suspected.

Case 19. Age, 34 years. Yard laborer, 1 month. Previously a gypsum shoveler, 8 months. Quiescent pulmonary tuberculosis. Had signs of active pulmonary tuberculosis and a positive sputum in June, 1924, when he was given outdoor work. In January, 1925, the disease appeared to be inactive.

Case 20. Age, 38 years. Gypsum shoveler, 1 month. Previously an air-brake inspector, railroad, 12 years. Fibrosis in both apices, evidently an old tuberculous condition; chronic bronchitis in both cases.

Case 21. Age, 18 years. Gypsum shoveler, 2 weeks. Previously a yard laborer, cement mill, 6 months. Latent tuberculosis in the apices of both lungs.

The report sums up the results of tuberculosis at the plant during the period of the study by stating:

"If cement dust exerted a detrimental influence, we should expect to find among employes who had definite tuberculous lesions which had become inactive, a lighting up of some of the inactive lesions; and among those who entered the industry with active

A. J. R. Curtis

tuberculosis an acceleration of the progress of the disease.

"Although 12 of the 23 men diagnosed as tuberculous were under our observation for three years, none of the cases appeared to progress unfavorably during this time. Of the two cases which were active, one become quiescent before the close of the study. The other, as previously stated, undoubtedly had the disease for a number of years before he began work in the cement plant. He was examined several times, and at each examination the disease showed little evidence of having progressed; nevertheless, the case terminated fatally in March, 1926.

"Although our observations are based on a comparatively small number of men, the conclusion seems warranted that Portland Cement does not, either in its primary irritation of the respiratory mucous membrane, or in the production of pneumonoconiosis, incite the development of pulmonary tuberculosis, as does a dust with a higher free silica content, and that the progress of either inactive or active cases of tuberculosis does not appear to be affected by the inhalation of cement dust."

Minor Respiratory Cases

The problem of respiratory diseases among cement workers apparently is confined tc disorders of the upper respiratory tract. Workers in the group studied by the Public Health Service experienced an abnormal number of attacks of diseases such as colds, acute bronchitis, affections of the pharynx and tonsils and light influenza or la grippe, which fall in this class.

It should be pointed out that the recorded number of these cases is "abnormal" probably because it includes attacks resulting in absences of as short duration as two days. Cases of two or three days duration are so mild that positive identification is not always possible; there is also the chance that illness such as "severe cold" or "mild grippe" were reported occasionally to cover absenteeism from other causes. If the term "minor respiratory" is applied only to cases of four days or longer duration, the number reduces to a figure which could not be considered excessive, weather and other circumstances considered.

Unsettled labor conditions during the progress of the study undoubtedly added to the absenteeism attributed to minor respiratory troubles. A considerable proportion of the common labor was "floating" and the turnover relatively high. Workmen of this class are usually uneducated in the matter of protecting themselves against unfavorable weather and many individuals of the group were probably improperly or inadequately clothed. Necessity for exposure to weather was somewhat greater at the time of the study than is usual today. Undernourishment probably was an occasional contributor to the high rate of susceptibility to colds and other minor ailments of this group.

There is ground for the belief that exposure to weather and low standards of living had a great deal to do with the high rate of minor respiratory diseases recorded by the Public Health Service. In the experience of various mill executives the presence of considerable dust in the atmosphere around a mill has produced no noticably worse condition as regards absenteeism because of sickness than was found at a similar mill where the atmosphere was less dusty, while the improvement in living conditions is usually reflected definitely in reduced volume of absenteeism. Considerable rheumatism was noted by the Public Health Service in certain departments. Rheumatism, which is invited by exposure to weather and obviously not affected by dust, was found to run parallel with the minor respiratory disease group.

Persons absent from work because of the heavy drinking of alcholic intoxicants once, or oftener for two days or more, during the Public Health Service's study experienced disability from minor respiratory diseases at

a rate which was 19% above that of other employes.

Other Ailments

Boils, the type of skin diseases most commonly encountered, occurred mostly during the summer in the finishing end of the mill, particularly in the packing department, according to the Public Health Service study. Summer heat, with resulting perspiration, which may be excessive in certain individuals, or heat and exposure to continued moisture often produce conditions under which an inflammation of the skin may develop excited by very little external irritation. The rubbing of the skin by any dust or dirt might easily cause boils through purely mechanical action, as the accumulation of any dust moistened by perspiration may form an abrasive irritant. The specific chemical qualities of cement mill dust are not regarded as an important factor.

Physicians of experience with these cases have expressed the opinion that remedial measures naturally start with personal hygiene. If cement packers, for example, can be educated to the point where they will take frequent shower baths (equipment for which is already provided for them in most cases at the mill) the accumulation of dust and perspiration would be removed before irritation could develop. Further benefits would result from changing underwear more frequently and from changing outer clothes when leaving work if the worker has perspired freely.

It is advisable, of course, for the worker to protect regions of probable irritation where possible; in the case of those who have tender skin, the hands should be protected with gloves. A continuation of the irritation, which may indicate hyper-sensitive condition of the individual skin should cause removal of the patient from exposure until the skin becomes normal.

The report referred to does not indicate an abnormal amount of rheumatism among cement workers in general, the higher attack rates being limited to the quarry and yard departments and among men in the mechanical department where there was exposure to sudden changes in atmospheric conditions. As workmen are educated to a point where they will wear proper and sufficient clothing, avoid unnecessary exposure and take precautions after it has been necessary for them to work under trying weather conditions, we may expect a reduction in rheumatism. Plant physicians are performing a splendid service in securing more attention to the tonsils, teeth and other possible centers of infection. The noticeable interest of the men in advanced methods now used by the medical profession is a very encouraging sign. Necessity for exposure to weather by mill employes has been noticeably reduced and further changes of this kind may be expected as new plants are built and older units rebuilt.

Conjunctivitis, usually taking the form of mild inflammation of the eyes appears frequently among employes of the packing departments. This condition is often caused by rubbing dust into the eyes or occasionally, when cement has gotten into the eyes through bursting of a bag or similar cause, by attempting to remove the particles by brushing with the fingers or hand.

All cement mill laboratories are provided with the simple equipment required to wash dust from the eyes. The practical elimination of eye inflammation therefore depends on educating the workmen not to rub the eyes after receiving a "shot" of dust, but rather to go directly to the laboratory for treatment with boric acid solution.

Sickness Versus Accidents

The report of the United States Public Health Service verifies other data indicating that the cement industry is not confronted with any serious occupational diseases. Nevertheless, it is known that in industry as a whole sickness of one kind or another causes considerably more loss of time than do personal injury accidents and we have no reason to doubt that this is true with regard to cement mills. In the cement industry absenteeism as a result of illness is largely made up of absences of short duration, suggesting the simple nature of most of the ailments and also the possibility of finding simple methods for reducing much loss of time now charged to sickness.

It would appear from recent experience that the problem of reducing absenteeism due to illness may be attacked effectively by:

(a) Keeping a record of absences due to sickness as carefully and in as great detail as mill accident records are now kept.

(b) Organizing effective propaganda to clean up the communities, homes and departments of the mill and to keep them clean, from the standpoints of both sanitation and neatness.

(c) Teaching personal hygiene and providing bathing and clothes drying facilities; solving the problem of bath facilities for workers families where necessary.

(d) Providing for personal hygiene instruction to the school children.

(e) Providing information to mothers on the selection of food, methods of preparation and home nursing.

(f) Where necessary, recommending to workers healthful apparel for various jobs and arranging with local stores to supply proper rather than improper clothing, shoes, etc.

(g) Offering the consulting services of the plant surgeon to workers on the surgeon's daily visit to the mill.

(h) Providing for periodical physical examination of workers as a health protective measure for them as well as for the protection of the employer.

Other steps may be taken, undoubtedly, but the list suggested above will be found to provide at least an effective basis for discussion of the subject. Most of the measures suggested have already been employed successfully in a number of mills and it is felt that they are at least worth a trial in any program to reduce absenteeism through illness.

Health of Workers in Portland Cement Plants

Reviewed by W. B. LENHART
Associate Editor, Rock Products

PUBLIC Health Bulletin No. 176, "The Health of Workers in Dusty Trades," 1928, issued by the United States Public Health Service, Treasury Department, at Washington, D. C., describes at length the methods used and results obtained during an investigation of the health of workers in dusty trades which covered, in the case of portland cement, a period of three years.

Six dusty industries, for purpose of comparison, were studied, they being cement, silver polishing (metal), granite, coal, cotton and street dusts. This bulletin is the first of the series and relates to investigations at a cement plant only.

From 500 to 1000 cement mill employes exposed to dust were selected for observation, supplemented by persons in the same industry but exposed to lesser amounts of dust. Three approaches to the problem were made. First, causes of absences of 2-day periods or longer were analyzed and results recorded. Second, all employes were given general physical examinations and persons suspected of having respiratory diseases had X-ray pictures taken of their chests by a specialist and a definite diagnosis made. Third, chemical and petrographic analyses were made of dusts at different places in the plant, and the weight of dust and the number of particles per cubic foot of air determined. The number of particles under 10 microns varied from 22,000,000 to 92,000,000 per cu. ft. air. Chemical analysis showed 62% lime and silica 22%. Free silica (quartz) varied from 1% to 6½%. The higher percentage of dust was in the crusher house.

It was found that in comparison with 11 non-dusty industries, cement-mill workers showed twice as great an average disability on account of respiratory diseases. Cement workers showed disability ratings 2⅞ times as many absences from work as rubber workers for respiratory diseases. Diseases of the skin were five times, of eyes, ears, tonsils and rheumatism three times the frequency of the other group for sickness periods of 2- to 7-day duration. For 7-day or more disability the rate was the same for both industries.

Compared to a second group representing miscellaneous industries the frequency of absence was about twice as great among cement-mill workers—influenza being the chief cause of the high rate. Cement-mill workers compared to the adult population of the town in which the plant was located showed about equal results as to sickness. All comparisons showed cement-mill workers to be espe-

cially susceptible to minor respiratory diseases; but it should be stressed that they were remarkably free from serious respiratory ailments. Pulmonary tuberculosis and pneumonia caused relatively little disability. The respiratory diseases apparently were confined to the upper respiratory tract.

Diseases of the skin showed high disability comparisons, especially during the summer months. Boils accounted for 70% of the absences from skin diseases and were confined mostly to men in the finishing departments. Rheumatism was confined mostly to the outdoor departments, with fewer cases in summer than in winter. Diseases of the eye showed conjunctivitis the most frequent. The effect of dust upon the special senses are of such a nature that no loss of time usually results. Men in the finishing department showed twice the frequency of absence due to gastrointestinal disturbances, indigestion, etc. The study indicated a high digestive disease rate, although the researches did not include the question of whether ingested cement dust affected the digestive tract.

The month of February showed the highest frequency of diseases in all the industries studied. Men under 25 years of age showed a high lost time rate, men 25 to 45 years of age showed the lowest, while after 45 years of age the rate was highest of all and was found to be 11% higher than the men under 25.

Only slight differences were noted in racial stock, which was 80% foreign-born Italians and the balance native-born Americans. Also no difference was noted between married and single men, although widowers and divorced men showed a high disability rate.

In regard to the general physical condition, the respiratory incidence rate was found to vary with the physical status, the rate being lowest among persons with minor physical defects and higher among those the examining physician considered in poor physical condition.

Alcoholic addicts showed a rate of disability 19% higher than the non-drinkers.

Among workers who quit and those who stayed a study showed that self-elimination weeded out that class that were inclined to diseases of the respiratory tract. Among the men who quit the rate was 68% higher than among those who stayed. Workers in the cement industry for two years or less showed a low rate, as did the men in the two- to four-year class. The four- to eight-year men were lowest; after that period of employment the tendency was for the rate to increase. Older employes not only developed one or more disabilities, but the frequency of the attacks increased, and ailments were chiefly confined to infections of the nasal mucosa and bronchi and influenza or grippe.

Leaving the heavy drinkers out of consideration, heavy dust breathers experienced 59% more respiratory and 94% more non-respiratory diseases than men working in less dusty places. Non-respiratory diseases among men working in less dusty places were diseases of the skin, eyes, ears and digestive tracts.

Heavy work, dusty atmosphere, the physically unfit and the men over 45 years of age showed highest rate or respiratory diseases. In the plant gypsum and kiln workers showed a high rate, although the small number of men required for these operations limited a definite conclusion.

Physical Examination Findings

Of 675 men recorded, 570 were given one or more physical examinations. Forty were referred to a chest specialist and 33 found with definite lung pathology. One-third of the employes had one or more respiratory defect or chronic condition. Employes with one defect were disabled 18% oftener, those with two defects 69% oftener than those free from respiratory ailments. Those who worked in dusty places showed the highest proportion of one or more respiratory defects. Inhalation of cement dust over a series of years tends to reduce vital capacity.

Pulmonary Tuberculosis Among Cement Workers

Of the 570 men examined, 21 were diagnosed as positive or suspected pulmonary tuberculosis. In only two cases was the disease active, and neither appeared to progress from dust causes. The history of the cases showed they were developed before entering the industry. One case died, while the other had become quiescent when the study closed.

Ten cases of chronic bronchitis were found. Apparently cement workers experience a high percentage of acute bronchitis, yet chronic cases were infrequent. Two cases of asthma, two emphysema and two chronic tonsilitis were found.

Of 53 men selected as a result of the chest X-ray films, 37 had been in the industry more than three years. Of the 37 men, 15 showed signs of pneumonoconiosis, three of the 15 also had tuberculosis, eight gave signs of arrested tuberculosis. Cement workers appear to have more than the normal amount of calcified nodes in the lungs.

In regard to diseases of the ear, it was found that cement dust with the wax formed a hard cement, which, if not removed, causes deafness. By removal of this material at regular intervals the trouble could be eliminated, and the accident rate cut as well, for many accidents can be traced to poor hearing.

The report concludes by calling attention to the improvements that have been made in dust control since these studies started. Most cement mills now have a company doctor and nurses so that at the present time there are in these plants a reduction in the number of disabling diseases.

The report also calls attention to the need of a standard for the allowable number of particles per cubic foot of air, and tests should be conducted often to check the content and keep the amount of dust under control.

Dust Collecting System to Be Expanded at Buffington Plant of Universal Portland

INSTALLATION of new dust collection equipment in the Buffington plant of the Universal Portland Cement Co., representing an expenditure of approximately $500,000, probably will be completed early next year, according to a recent announcement of J. H. Kempster, superintendent of the plant.

With installation of the new improvement in the Buffington plant some 90% of dust resulting from the manufacture of cement will be eliminated, relieving the so-called "dust nuisance," it was stated.

Residents and officials of the East Chicago-Indiana Harbor municipality received Superintendent Kempster's announcement with approval. Dust from the cement plant long has been considered a nuisance and a menace to public health, according to city officials. The "dust nuisance" had been looked upon with so much disapproval that two years ago the city governing body appropriated a considerable sum for legal expenses by which it was proposed to make attempts to compel the cement company to find some means of eliminating the dust. Initial stone toward installation of the new dust collecting equipment last May were said to have followed a series of conferences between Mayor Raleigh P. Hale of East Chicago and officials of the company.—*Gary* (Ind.) *Post-Tribune.*

Northwestern States Portland Cement Co. at Gilmore City n Operation

MANY FORMER EMPLOYES have returned to Gilmore City, Iowa, and resumed work at the cement plant after an absence of two or three years.

Among those who have returned are: J. W. Kimball, Fort Worth, Texas; Henry Gray, La Grande, Ore.; Herman Phillips and Oscar Hyde, Dixon, Ill.; Joseph Welch, Salisbury, Mo.; N. J. Edwards, Ironton, Ohio; Howard Klener, from California; Isaac Colglazier, Humboldt, Kan.; Emmet Gaffron, Decatur, Ill.

The company has also secured its former superintendent, H. Webster, who returned from Redlands, Calif. Many new men have also been employed, and the cement plant is now running full force. The plant is shipping out about 10 carloads of cement each day and about 15 carloads of commercial rock.—*Fort Dodge* (Iowa) *Messinger.*

American Refractories Institute to Meet in New York

AN announcement has been received from the American Refractories Institute stating that the organization will hold its fall meeting in New York City on October 24. The meeting will be held at the Vanderbilt hotel.

Editorial Comment

The Price of Progress

All change, of course, is not progress, but change we must for better or for worse, because we live in a changing world. Evolution is not confined to the animal and vegetable kingdoms, but to all business and industry as well. The methods, equipment, management and products of yesterday will not necessarily fit into the scheme of things of tomorrow, whether we would like to have them or not. Standards and standardization are helpful but temporary. Since we must change with the times and continually readjust ourselves and our businesses and our industries to new conditions and new environments, let's do so as intelligently as possible to try to insure that the change is progression and not retrogression; and let producers and manufacturers lead in progress, not follow.

Foresighted men in all lines of business and industry try to anticipate not only the *extent* of the demand for the particular commodity they are interested in, but the *direction* the demand is taking. Some changes take place so fast they are almost paralyzing to some industries; for example the change in women's clothing from cotton fabrics to scanty silk and rayon. There seems nothing left for the manufacturer of cotton fabric to do but to find new outlets for cotton fabric, and that is just what they have organized to do. The increased industrial uses of cotton fabric are just now beginning to offset its remarkable decline for use in clothing. Fortunately no such sudden changes threaten the rock products industries, yet changes are taking place that require foresight and sound judgment.

For example, there has always been a strong prejudice on the part of lime and cement manufacturers to the use of "foreign admixtures" of any kind with their materials. To some lime manufacturers lime is the perfect mortar and plaster material; the addition of anything is an adulteration. Yet lime has steadily lost ground in the building field because it lacked certain requisites that a constantly growing number of users want, and which competitive materials have, at least in part, supplied. To some portland cement manufacturers "standard" portland cement is entirely sufficient unto itself for all purposes. The addition "inert fillers" is worse than useless. Yet, unless some eminent authorities are entirely wrong, even portland cement for special purposes, and perhaps for all purposes, may be improved by such admixtures as the pozzolanas.

A certain amount of resistance to change from something that is undeniably good to something there is reasonable doubt about, and whole-hearted loyalty to one's product, is always commendable. But there comes a time when conservativeness ceases to be a virtue. There is always in every industry a group of progressives who continually endeavor to find out what their customers want and to anticipate those wants—not in quantity alone but in desired qualities and service. Such manufacturers, while fully appreciating the virtues of the commodity already on the market never close their eyes to the commercial advantage of overcoming prejudice from either real or alleged defects.

Far more research work in many industries has been done with the idea of demonstrating the virtues of a material than in honestly seeking for shortcomings with a view to correcting them. In all the years of organized effort on the part of the lime industry to promote the use of lime in its oldest and most important field—construction—we do not recall any research to see if lime could not be made the basis of a "perfect" mortar or plaster. It has been assumed at the start that it *was* the perfect mortar material, all other opinion to the contrary notwithstanding. We do not recall any organized, co-operative research work on lime and pozzolanas, which should be the starting point to re-establish lime in the building industry.

Experience after experience has established that all standard portland cement is not the "perfect" material that it might be for sea-water construction, but what has been done on the part of the average cement manufacturer to make a material that would be "perfect" under these conditions? The aggregates used or the construction methods are generally shouldered with—with some justification too in most instances—at least a portion of the blame. One of these days a progressive manufacturer will place such a cement on the market and the others will wonder why they did not do it first.

If portland cements with admixtures of pozzolanas are really desirable why should the manufacturer of cement not make them a part of the cement instead of leaving it to the user to make the admixture? It is both desirable and profitable to add gypsum to portland cement; why not a pozzolana?

The progressive manufacturer is not content to meet present demand. If he can not grow and profit by increasing the demand for the product he is making he will invariably seek to grow by developing something that will create a new or a different kind of demand. That is taking place today in the portland cement industry among many others; and only a beginning has been made. Its eventual outcome is uncertain, but probably it is quite as apt to be a better all-around standard portland cement, as quick-hardening or other special cements. At least the manufacturers who do not provide against that eventuality may be short-sighted.

Financial News and Comment

RECENT QUOTATIONS ON SECURITIES IN ROCK PRODUCTS CORPORATIONS

Stock	Date	Bid	Asked	Dividend
Allentown P. C. com.[37]	12-30-27	3	7	
Allentown P. C. 1st 6's[37]	12- 5-27	90	92	
Alpha P. C. new com.	9-24-28	44	46	75c qu. Oct. 15
Alpha P. C. pfd.[2]	9-24-28	117	.....	
Amer. Aggregate 6's, bonds	9-26-28	103½	104½	
Am. L. & S. 1st 7's[32]	2-24-28	101¾	102½	
American Silica Corp. 6½'s	9-26-28	96	100	
Arundel Corp. new com.	9-25-28	38½	39⅛	50c qu. July 2
Atlantic Gyp. Prod. (1st 6's & 10 sh. com.)[10]	7-18-28	103	109	
Atlas P. C. com.	9-24-28	39	41	50c qu Sept. 1
Atlas P. C. pfd.	9-24-28	47	49	66⅔c qu. July 2
Beaver P. C. 1st 7's[30]	9-20-28	97	100	
Bessemer L. & C. Class A[4]	9-26-28	35	35¼	75c qu. Aug. 1
Bessemer L. & C. 1st 6½'s[4]	9-24-28	100½	101	
Boston S. & G. com.[16]	9-21-28	77¾	.....	$1 qu. July 2
Boston S. & G. 7% pfd.[16]	9-21-28	83	86	1¾% qu. July 2
Boston S. & G. Co. 1st pfd.[16]	9-21-28	93	96	2% qu. July 2
Canada Cem. com.[43]	9-25-28	28½	29	
Canada Cement pfd.[43]	9-25-28	99	99½	1.62½ qu. Sept. 30
Canada Cement 5½'s[43]	9-22-28	101	102½	
Canada Cr. St. Corp. 1st 6½'s	9-22-28	96	100	
Canada Gyp. & Alabastine	9-25-28	68	69½	75c Oct. 1
Certainteed Prod. com.	9-26-28	40	40½	$1 qu. Oct. 1
Certainteed Prod. pfd.	9-26-28	96	96½	1.75 qu. Oct. 1
Cleveland Stone new st'k	9-26-28	50	60	50c qu. Sept. 1 & 25c ex.
Columbia S. & G. pfd.	9-24-28	91½	93	
Consol. Cement 1st 6½'s, A[42]	9-26-28	94	99	
Consol. Cement 6½ notes[24]	9-26-28	92	96	
Consol. Cement pfd.[41]	9-26-28	40	60	
Consol. S. & G. com. (Canada)	9-25-28	13½	.....	
Consol. S. & G. pfd. (Canada)	9-25-28	84	.....	
Consumers Rock & Gravel, 1st Mtg. 6's, 1948	9-21-28	97	99½	
Coosa P. C. 1st 6's[32]	12-28-27	65	75	
Coplay Cem. Mfg. 1st 6's[40]	9-10-28	90	.....	
Coplay Cem. Mfg. com.[40]	9-10-28	12½	.....	
Coplay Cem. Mfg. pfd.[40]	9-10-28	72½	.....	
Dewey P. C. 6's[20]	9-26-28	99	.....	
Dolese & Shepard[7]	9-26-28	140	145	$2 qu. Oct. 1 $1 ex. Oct. 1
Edison P. C. com.[19]	9-21-28	10c	.....	
Edison P. C. pfd.[19]	9-21-28	50c	.....	
Edison P. C. bonds[19]	9-21-28	75	.....	
Fredonia P. C. 1st 6½'s[32]	12-28-27	97	101	
Giant P. C. com.	9-24-28	25	35	
Giant P. C. pfd.	9-24-28	30	40	3½% June 15
Ideal Cement, new com.	9-25-28	73	76	75c Oct. 1
Ideal Cement 5's, 1943	9-22-28	101½	103	
Indiana Limestone 6's	9-26-28	90½	.....	
International Cem. com.	9-24-28	69½	70½	$1 qu. Sept. 28
International Cem. bonds 5's	9-26-28	96¾	97	Semi-ann. int. payable June 15
Iron City S. & G. bonds 6's[40]	9-21-28	98	98½	
Kelley Is. L. & T. new st'k	9-26-28	52⅜	54	62½c qu. Oct. 1
Ky. Cons. Stone Co. com.[48]	9-20-28	13	15	
Ky. Cons. St. com. Voting Trust Certif.[48]	9-20-28	13	15	
Ky. Cons. Stone 6½'s[48]	9-20-28	97½	100	
Ky. Cons. St. Trustee Certif.[48] (1 sh. 7% cum. pfd. & 1 sh. com. stock)	9-20-28	100	103	$1.75 Aug. 1
Keystone Sand & Sup. 6's[47]	8-22-28	99	100	
Lawrence P. C.[2]	9-24-28	95	100	2% qu. Sept. 29
Lehigh P. C.[2]	9-24-28	48	50	62½c qu. Nov. 1
Lehigh P. C. pfd.[2]	9-24-28	110	.....	1¾% qu. Oct. 1
Lyman-Richey 1st 6's, 1932[13]	9-21-28	98	100	
Lyman-Richey 1st 6's, 1935[13]	9-21-28	97½	99½	
Marblehead Lime 1st 7's[34]	9-21-28	100	.....	
Marbleh'd Lime 5½'s, notes[34]	9-21-28	98	.....	
Mich. L. & C. com.[39]	9-21-28	35	.....	
Missouri P. C.	9-25-28	44	44½	50c qu. Aug. 1
Monolith P. C. com.[9]	9-22-28	15	.....	8% ann. Jan. 2
Monolith P. C. pfd.[9]	9- 5-28	9½	10	
Monolith P. C. units[9]	9- 5-28	34¾	36¼	
National Cement 1st 7's[38]	9-21-28	99	101	
National Gypsum A com.[35]	9-26-28	.....	21	
National Gypsum pfd.[35]	9-26-28	.....	68	1¾% qu. Apr. 1
Nazareth Cem. com.	9-21-28	29	32	75c qu. Apr. 1
Nazareth Cem. pfd.	9-21-28	100	.....	
Newaygo P. C.[2]	12-30-27	115	.....	
Newaygo P. C. 1st 6½'s[32]	2-11-28	120	.....	
New Eng. Lime pfd., A[41]	9-25-28	80	85	
New Eng. Lime pfd., B[41]	9-25-28	70	75	
New Eng. Lime com.[41]	9-25-28	10	28	
New Eng. Lime 1st 6's[14]	9-21-28	98	100	
N. Y. Trap Rock 1st 6's	9-21-28	100	.....	
North Amer. Cem. 1st 6½'s	9-26-28	70	71¼	
North Amer. Cem. com.[10]	9-21-28	7	8	
North Amer. Cem. 7% pfd.[10]	9-21-28	30	35	1.75 qu. Aug. 1
North Amer. Cem. units[10]	9-21-28	30	40	
North Shore Mat. 1st 5's[16]	9-26-28	98½	.....	
Northwestern States P. C.[37]	9-21-28	195	205	
Pac. Coast Cem. 6's. A	9-20-28	96	98½	
Pacific P. C. new com.[5]	9-20-28	18	20	
Pacific P. C. pfd.	9-20-28	74⅞	.....	1.62½ qu. Apr. 5
Pacific P. C. 6's	9-20-28	98	100½	
Peerless Egyp'n P. C. com.[1]	9-25-28	1⅝	2⅛	
Peerless Egyp'n P. C. pfd.[1]	9-25-28	70	80	1¾% qu. July 1
Penn-Dixie Cem. 1st 6's[29]	9-26-28	94½	95	
Penn-Dixie Cem. pfd.[28]	9-27-28	83	88	1.75 qu. Sept. 15
Penn-Dixie Cem. com.	9-27-28	15¼	15⅞	50c qu. July 1
Penn. Glass Sand Corp. 1st 6's, 1952	9- 4-28	101½	103	
Petoskey P. C.	9-25-28	9¼	10¼	1½% qu.
Pittsfield L. & S. bonds[31]	10- 8-27	.....	100	
Pittsfield L. & S. com.[31]	10- 8-27	.....	25	
Riverside P. C. com.	9-22-28	15	.....	
Riverside P. C. 1st pfd.	9-20-28	95	100	1.50 Aug. 1
Riverside P. C., A	9-22-28	21	.....	31¼c cum. part. Aug. 1
Rockland-Rockport Lime 1st pfd.[10]	5-17-28	.....	100	3½% s.-a. Feb. 1
Rockland-Rockport Lime 2nd pfd.[10]	5-17-28	.....	60	3% s.-a. Feb. 1
Rockland-Rockport Lime com.[10]		no market		1½% qu. Nov. 2
Sandusky Cem.	9-26-28	220	250	$2 qu. July 2
Santa Cruz P. C. bonds	9-22-28	105¾	106½	6% annual
Santa Cruz P. C. com.	9-22-28	89	.....	$1 qu. Oct. 1
Schumacher Wallboard com.	9-22-28	20	21½	50c May 15
Schumacher Wallboard pfd.	9-22-28	25¼	26	
Southwestern P. C. units[44]	9-21-28	270	.....	
Superior P. C., A[20]	9-20-28	53	54	27½c mo. Aug. 1
Superior P. C., B[20]	9-20-28	33	34	
Trinity P. C. units[37]	9-21-28	153	157	
Trinity P. C. com.[37]	9-21-28	52	.....	
U. S. Gypsum com.	9-26-28	61	62	2% qu. Sept. 30
U. S. Gypsum, rts.	9-26-28	16⅝	16¾	
U. S. Gypsum pfd.	9-26-28	125½	126	1¾% qu. Sept. 30
Universal G. & L. com.[3]	9-26-28	.....	1	
Universal G. & L. pfd.[3]	9-26-28	.....	12	1½% Feb. 15
Universal G. & L., V.T.C.	9-26-28	no market		
Universal G. & L. 1st 6's[3]	9-26-28	53	60	
Upper Hudson Stone 1st 6's, 1951[32]	12-28-27	92	.....	
Vulcanite P. C. 1st 7½'s[32]	12- 5-27	105	109	
Chas. Warner com.	9-21-28	33	36	50c qu. July 10 & 25c ex.
Chas. Warner pfd.	9-21-28	109	.....	1¾% qu. July 26
Whitehall Cem. Mfg. com.[26]	9-24-28	150	.....	
Whitehall Cem. Mfg. pfd.[26]	9-24-28	98	.....	
Wisconsin L. & C. 1st 6's[15]	9-26-28	100	.....	
Wolverine P. C. com.	9-25-28	5½	6½	15c qu. Aug. 15
Yosemite P. C., A com.[50]	9-20-28	5¼	6	

[1]Quotations by Watling, Lerchen & Hayes Co., Detroit, Mich. [2]Quotations by Bristol & Willet, New York. [3]Quotations by Rogers, Tracy Co., Chicago. [4]Quotations by Butler, Beading & Co., Youngstown, Ohio. [5]Quotations by Freeman, Smith & Camp Co., San Francisco, Calif. [6]Quotations by Frederic H. Hatch & Co., New York. [7]Quotations by F. M. Zeiler & Co., Chicago, Ill. [8]Quotations by Ralph Schneeloch Co., Portland, Ore. [9]Quotations by A. E. White Co., San Francisco, Calif. [10]Quotations by Lee Higginson & Co., Boston and Chicago. [11]Nesbit, Thomson & Co., Montreal, Canada. [12]E. B. Merritt & Co., Inc., Bridgeport, Conn. [13]Peters Trust Co., Omaha, Neb. [14]Second Ward Securities Co., Milwaukee, Wis. [15]Central Trust Co. of Illinois, Chicago. [16]J. S. Wilson, Jr., Co., Baltimore, Md. [17]Chas. W. Scranton & Co., New Haven, Conn. [18]Dean, Witter & Co., Los Angeles, Calif. [19]Hoit, Rose & Troster, New York. [20]Quotations by Bond & Goodwin & Tucker, Inc., San Francisco. [21]Baker, Simonds & Co., Inc., New York. [22]Pirnie, Simons and Co., Springfield, Mass. [23]Blair & Co., New York and Chicago. [24]A. B. Leach and Co., Inc., Chicago. [25]Richards & Co., Philadelphia, Penn. [26]Hincks Bros. & Co., Bridgeport, Conn. [27]J. G. White and Co., New York. [28]Mitchell-Hutchins Co., Chicago, Ill. [29]National City Co., Chicago, Ill. [30]Chicago Trust Co., Chicago. [31]McIntyre & Co., New York, N. Y. [32]Hepburn & Co., New York. [33]Boettcher & Co., Denver, Colo. [34]Kidder, Peabody & Co., Boston, Mass. [35]Farnum, Winter and Co., Chicago. [36]Hanson and Hanson, New York. [37]S. F. Holzinger & Co., Milwaukee. Wis. [38]McFetrick and Co., Montreal, Que. [39]Tobey and Kirk, New York. [40]Steiner, Rouse and Stroock, New York. [41]Hornblower & Weeks, New York City and Chicago. [42]E. H. Rollins, Chicago, Ill. [43]Jones, Heward & Co., Montreal, Que. [44]Tenney Williams & Co., Inc., Los Angeles, Calif. [46]Stein Bros. & Boyce, Baltimore, Md. [47] Bank of Pittsburgh, Pittsburgh, Pa. [48]E. W. Hays & Co., Louisville, Ky.

INACTIVE ROCK PRODUCTS SECURITIES (Latest Available Quotations)

Stock	Price bid	Price asked
American Brick Co. pref. (sand-lime brick) 16 sh.[6]	par 25	25¾
Benedict Stone Corp. (cast-stone), 50 pfd., 390 com.[1]	$400 for the lot	.....
Benedict Stone Corp. 1st 7's 1934[8]	.....	86
International Portland Cement Co., Ltd., pfd.	30	45
Knickerbocker Lime Co.[4]	105	.....
Olympic Portland Cement Co.[7]	.....	£1⅝

Stock	Price bid	Price asked
Simbroco Stone Co.,[10] 10 sh. pfd., par $50	$10.25 per sh.	
Southern Phosphate Co.[6]	1¾	.....
Vermont Milling Products Co. (slate granules), 22 sh. com. and 12 sh. pfd.[6]	$1 for the lot	.....
Wabash Portland Cement Co.[3]	60	100
Winchester Brick Co., pfd., sand lime brick[5]	10c	.....

[1]Price obtained at auction by Adrian H. Muller & Sons, New York. [3]Price obtained at auction by Weilupp-Bruton and Co., Baltimore, Md. [4]Price obtained at auction by Barnes and Lofland, Philadelphia, on April 4, 1928. [5]Price obtained at auction for lot of 50 shares by R. L. Day and Co., Boston, Mass. [6]Price obtained at auction by Wise, Hobbs and Arnold, Boston, Mass. [7]Neidecker and Co., London, England. [8]Auction sales of $1000, Barnes & Lofland, Philadelphia, March 31, 1928. [10]Price at auction, June 6, 1928, R. L. Day & Co., Boston, Mass.

Petoskey Cement Offers New 6% Gold Notes

THE Continental National Co., Chicago, Ill., is offering $1,500,000 in serial 6% gold notes, dated August 1, 1928, of the Petoskey Portland Cement Co., Petoskey, Mich. The following is from a letter of J. B. John, president of the company, to the bankers:

PROPERTIES AND BUSINESS—The Petoskey Portland Cement Co., incorporated under the laws of Delaware, February 5, 1917, was organized to acquire a large and well known crushed-stone business which is still being operated. The stone proved to be of a quality particularly adaptable to the manufacture of high-grade cement and consequently a cement plant was built and operations commenced in March, 1921. Since then, the manufacture and sale of portland cement has been the company's principal business and source of earnings. The plant is advantageously located on Little Traverse Bay, affording it exceptional shipping facilities by water and rail. Lake shipments are loaded and unloaded at the company's own concrete dock, reputed to be one of the finest on Lake Michigan.

The company owns all the equipment necessary for efficient and economical operation, including locomotives, freight cars, steam shovels and cranes. It also owns an electric power plant, from which current in excess of its own requirements is generated and sold. The manufacturing plant originally consisted of a two unit, straight-line producing mill with an annual capacity of 750,000 bbl. of cement. In June, 1925, the plant capacity was doubled and the company is now operating four units with a total annual capacity of 1,500,000 bbl. Its properties are maintained in excellent physical condition.

Directly adjacent to its mill, the company owns an extensive limestone quarry covering approximately 400 acres of rock property with 22 miles of water front. It is estimated that the quarry contains sufficient limestone above lake level to furnish the company's present requirements for at least 100 years. The stone is of high quality and can be used for commercial purposes other than the manufacture of cement.

OPERATIONS—The company's plant is considered one of the most modern cement mills in the country. The wet process of manufacture is employed and through the installation of up-to-date equipment and the use of modern methods, the cost of production has been reduced to most economical limits.

Our product is sold under the trade name of "Petoskey Portland Cement" and is widely distributed throughout Michigan, Wisconsin, the northern portions of Minnesota, Illinois and Indiana and western Ohio. The company has built up a strong dealer organization from which it receives a steady demand, part of its production being distributed for large construction work and county and state road building.

The plant is under continuous operation, and the supply of finished cement accumulating during the winter months is stored in modern silos holding approximately 25% of the yearly output. This surplus, together with complete packing and shipping facilities, gives the company a decided advantage in meeting the heavy spring and summer demands, and makes possible the shipment of more cement than the average plant of the same productive capacity.

The Petoskey Transportation Co. carries considerable of our product by water, giving us the benefit of low freight rates to all Great Lakes ports and relieving us from complete dependence on railroads for transportation facilities. The cost of bringing coal to the mills is also greatly reduced by the use of the Transportation company's steamship.

PURPOSE OF ISSUE—The proceeds of this issue of notes will be used to retire approximately $600,000 serial notes dated December 1, 1925; $315,500 notes payable to Petoskey Transportation Co. due February 1, 1934, and for additions and improvements to the company's properties.

PROVISIONS OF ISSUE—These notes are a direct obligation of the Petoskey Portland Cement Co. issued under an indenture which provides, among other things, that so long as any of these notes are outstanding no mortgage, encumbrance or lien shall be placed upon any of the company's assets, and that the company shall not incur or create any obligations having a maturity longer than 12 months, unless incurred for the acquisition of or improvements to present properties and then only if the total indebtedness of the company including that to be created shall not exceed 40% of the company's assets.

EARNINGS—The sales and earnings of the company for the three years ended December 31, 1927, as certified to by Ernst and Ernst were as follows:

NET EARNINGS BEFORE INTEREST AND FEDERAL TAXES

Calendar year	Sales	Before depreciation and depletion	After depreciation and depletion	Times maximum Interest charges
1925	$1,616,429	$476,733	$338,153	3.75
1926	1,934,575	531,829	367,747	4.08
1927	2,131,768	591,291	418,804	4.65
Annual average	$1,894,257	$533,284	$374,901	4.16

Due to unseasonable weather in the early spring and to lower prices for cement, earnings this year are at a lower rate than last year, the company estimating that earnings for the full year will be approximately three times maximum annual interest charges on these notes.

It is expected that after the company has received the benefits of the improvements to be made and new property to be acquired with the proceeds of these notes, earnings will exceed those of former years.

MANAGEMENT—The management of the company will continue under the direct supervision of experienced men, all of whom are large stockholders in the company and have been prominently identified with it since its inception. In addition to my connection with this company, I am also president and general manager of the Sandusky Portland Cement Co. and the Manitowoc Portland Cement Co.

Our board of directors includes successful men engaged in this and other lines, and our company, to the best of our knowledge, has always enjoyed the full confidence of the trade.

PETOSKEY PORTLAND CEMENT CO., PETOSKEY, MICH.

BALANCE SHEET

At the close of business December 31, 1927, adjusted to give effect to the sale of $1,500,000 of serial 6% gold notes and the application of proceeds to the reduction of certain liabilities, the balance reserved for acquisition of additional properties and new construction.

(As certified by Ernst & Ernst)

ASSETS

Current:		
Cash		$ 213,869.50
Customers' accounts receivable, less reserve		101,936.24
Inventories, as certified by management		490,720.99
Total current		$ 806,526.73
Other assets		$ 4,449.58
Permanent:		
Land, deposits, buildings and equipment as appraised by the Coats & Burchard Co. at November 26, 1923, plus subsequent additions at cost less accrued depreciation	$2,896,449.07	
Cash balance of proceeds of this financing reserved for acquisition of additional properties and new construction	461,500.00	
	$3,357,949.07	
Deferred	91,016.53	
	$4,259,941.91	

LIABILITIES

Current:		
Notes payable	$ 5,000.00	
Accounts payable and accrued	120,360.21	
Federal income taxes	50,563.38	
Total current		$ 175,923.59
Long term indebtedness—Serial 6% gold notes		$1,500,000.00
Nominal:		
Capital stock—Authorized $2,500,000		$1,998,350.00
Surplus		595,668.32
		$2,584,018.32
		$4,259,941.91
Contingent liability—Customers' notes discounted		$ 16,851.10

*Reprint from the September issue of *Rocks and Minerals.*

Canada Gypsum Earnings

EARNINGS of the Canada Gypsum and Alabastine, Ltd., for the first six months of the current year are understood to have been substantially in excess of all charges including the present 3% dividend on the common shares. The company looks forward to improving earnings in the last six months of 1928, the fall being its best season.

Though export business was really started by this company in 1921 it was only two years ago when any kind of organized effort was made to secure business in overseas markets. Since then products of the company have been shipped to 25 different markets of the world, including Great Britain, Holland, South Africa, New Zealand and the South and Central American countries and with the new trip expectations are that additions will be made to the last.

The strength in the shares of Canada gypsum can partly be attributed to the excellent showing the company has made of late, particularly in the foreign field.

Recent Dividends Announced

Alpha Portland Cement com. (quar.) ..... 75c, Oct. 15
Canada Gyp. & Alabastine .... 75c, Oct. 1
Ideal Cement com. (quar.) .. 75c, Oct. 1
Kelley Island L. & T. com. (quar.) ..... 62½c, Oct. 1
Lehigh Portland Cement com. (quar.) ..... 62½c, Nov. 1
Santa Cruz Portland Cement com. (quar.) ..... $1, Oct. 1
Union Rock pfd. ..... $1.75, Oct. 1

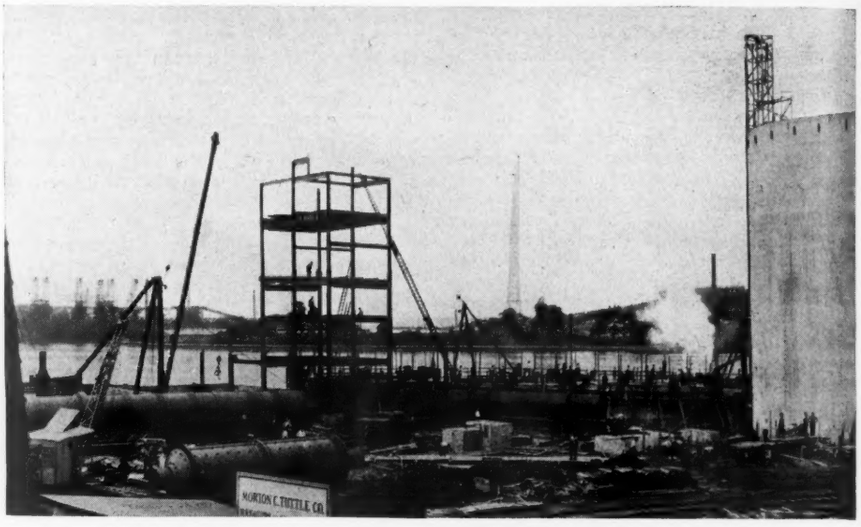
Progress on New U. S. Gypsum Co. Plant at Boston

THE FIRST of the four new plants included in the 1928 expansion program of the United States Gypsum Co., Chicago, Ill., is now under construction at Boston, Mass. The plant as designed consists of a complete layout for the manufacture of a full line of the gypsum products from the raw material. The site is in the Charlestown district of Boston, on tidewater at the mouth of the Mystic river, and was selected particularly to permit the delivery of raw material by boat from the Canadian mines of the company. To meet this requirement, it was necessary to provide rock storage, and accordingly one of the main features of the plant is the battery of five large reinforced concrete silos located at the waterfront edge of the development. These silos are cylindrical, 46 ft. in diameter and 86 ft. in height, each having a capacity of 5000 tons of rock. With these is connected one small silo of 20 ft. diameter for the storage of stucco.

An existing wharf at the edge of the property has been strengthened and reconstructed where necessary and will support a traveling unloader. From this unloader the material will be received in a gallery extending over the tops of the silos and housing a conveyor. A concrete tunnel 8 ft. wide and 6 ft. high extends under the center line of the silos, and through this the material will be conveyed to the rotary calciners. The manufacturing structures include a wall-board plant, calcining mill, warehouse, office, pump and switch house, etc. The main structures will be of steel frame, of heavy design, with concrete floors, brick walls and gypsum roofs. Two lines of tracks will run into the buildings. Foundations for buildings and silos, as well as for much of the heavy machinery, are of concrete, supported by concrete piles, of which nearly 3000 were required.

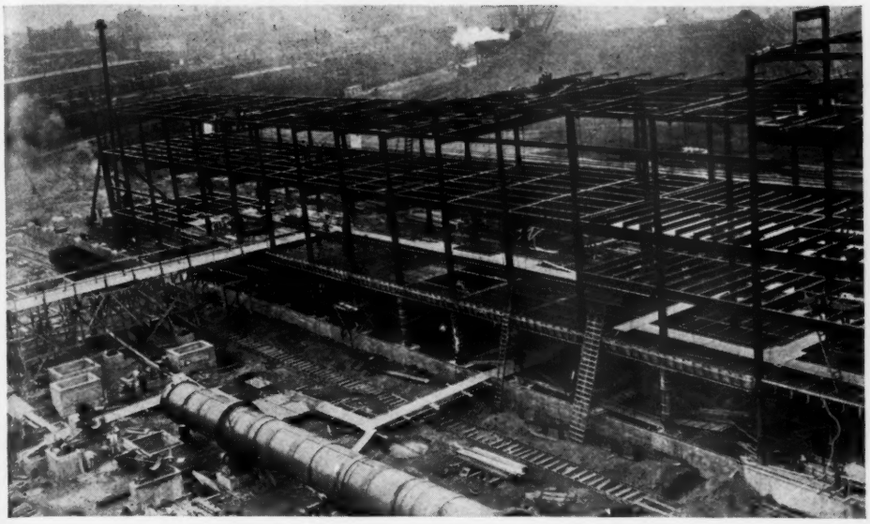
Oil will be used for fuel and the plant includes a concrete structure which houses two steel tanks of 50,000 gal. capacity each.

The management of this development, including besides construction the erection of all machinery, is in the hands of the Morton C. Tuttle Co., Boston. Work is proceeding



The waterfront section of the plant showing two silos completed, and the calciner in two sections being moved into position. Tube mill in left foreground

General view of the site soon after construction started. The picture shows the start on the construction of the first two silos in the foreground, with work on the oil storage building under way at the right in the rear



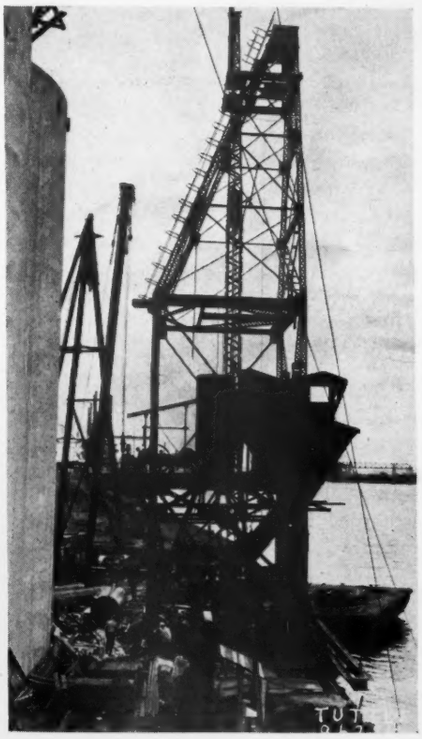
Board mill of the new gypsum plant partially framed with concrete floors under construction

rapidly on every section of the plant and it is expected that the plant will be in operation early in 1929. The three other new plants under construction are at Philadelphia, Detroit and East Chicago, Ill.

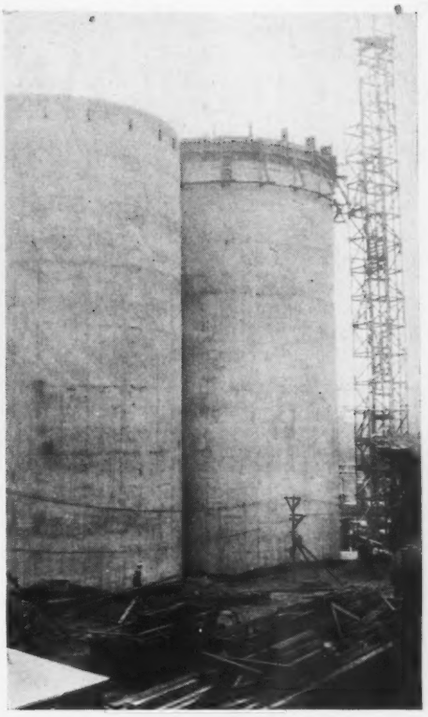
O. F. Chichester Buys Quarry in California

ACCORDING to a report in the *San Leandro* (Calif.) *Reporter*, O. F. Chichester of Stockton, Calif., has purchased the stone quarry of Joseph Costello, located near Lake Chabot. Mr. Chichester was formerly head of the Hudson Lumber Co. in San Leandro, but left two years ago to take charge of the California Cedar Products Co. at Stockton. He has been interested in a number of different projects and has added the operation of this rock quarry to his other interests as he states that he sees a great future in the quarry business in general and in this quarry in particular. Chris Hopper, the San Leandro building inspector, has been placed in charge of the quarry and has resigned his position with the city. It is stated that the quality of the rock from the quarry is exceptional. The plant will turn out a number of various sizes of crushed stone.

Calciner during the course of erection at the new plant



Erecting the unloader on the wharf



Two of the silos at the Charleston plant practically complete

Bayou Sand and Gravel Co. to Open Pit at Columbus, Tex.

THE Bayou Sand and Gravel Co. of Houston, Texas, is planning to open a gravel pit on a 500-acre tract of land near Columbus, Texas, a short distance south of the old Ilse gravel pit, and will also operate a large brick manufacturing plant on the property. The concern has been incorporated under the laws of Texas, and will have a capital sufficient to operate a modern brick making plant in connection with the gravel and sand business. The land on which this industry is located contains a large quantity of several varieties of clay.

Operations have not begun on the ground as yet, but the company is getting its affairs in shape and hopes to get started at production in the next few months.—*Columbus* (Texas) *Citizen*.

Looking down into one of the completed silos, showing connecting tunnel at the bottom

Foreign Abstracts and Patent Review

Suggested Improvement in Rotary Kiln. Dr. N. C. Kyriacou attempts to improve the thermic balance of the rotary kiln by providing a swell inside at the entrance to the sintering zone of the standard rotary kiln of uniform diameter, as shown in Figs. 1 and 2. This effects a gathering of the raw mixture and its prolonged stay in the calcining zone, and also an increased kinetic velocity of the combustion gases due to a decrease in the kiln cross-sectional area; and therefore a better thermic transmission, better calcining and ripening of the material. On the other hand, the sintering zone is kept open by the swell, thereby providing a greater volume and slower movement of the gases, which increases the radiation heat transfer. Thus the advantages of the rotary kiln with widened sintering zone and of the rotary kiln with widened calcining zone are combined in this new arrangement, the swell being of any design suiting the diameter of the kiln, the nature of the flame and the substances handled, and consisting of fireproof material or of a framework covered with fireproofing, or it may eventually be designed as an air heater for the combustion air. Kyriacou suggests, since the greatest supply of heat is supplied to the sintering zone by radiation, that about 30 to 50% of the entire necessary heat be supplied as solid carbon from cheap wastes to the raw kiln material, thereby relieving the combustion chamber of the rotary kiln and securing a more theoretically complete combustion, briquetted fuel being preferable to prevent pre-timely burning of the combustible. The suggestion which dates back to 1925, is just now coming into use in metallurgical processes.—*Zement* (1928), **17**, 25, 973-975.

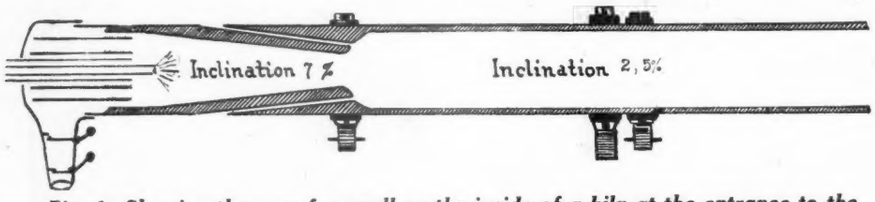


Fig. 1. Showing the use of a swell on the inside of a kiln at the entrance to the sintering zone as an aid to the thermic balance

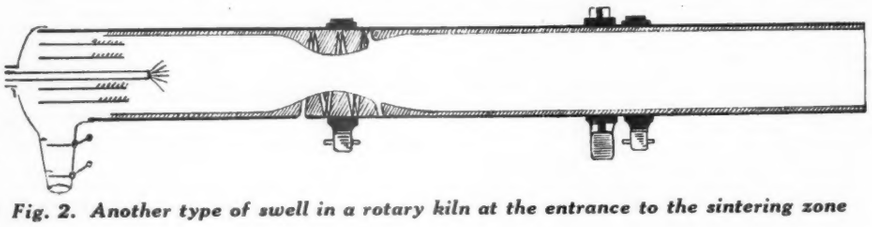


Fig. 2. Another type of swell in a rotary kiln at the entrance to the sintering zone

Failure of Lean Concrete Mixtures to Harden. Dr. Bernward Garre states that more attention should be given to the amount of alkali chloride salts present in cement mixtures. Because of the improved quality of cements being produced, leaner mixtures are coming into use. The same percentage of harmful salts which in rich mixtures would cause no noticeable damage, may in the use of high quality cements, and therefore lean mixing conditions lead to complete destruction of the concrete.—*Zement* (1928), 234-235.

Comparative Tests With Perforated and Wire Screens. As a common rule the use of mesh screens will produce coarser screenings than would be obtained with the use of perforated screens whose perforations correspond with the clearance of the mesh screens. Trials have shown that in sand and gravel mixtures there is a variation of 2.9-13.7%. If the size of the perforations of the sheet metal screens is compared with the diagonal measure of the wire screens and not with their clear openings, the variation will be reduced from 1.5-7.5%. It was proven by experiment that a perforation measure of 7 mm. is equal to a 5-mm. wire screen.—*Steinindustries* (1928), 9-11.

Determination of Loss by Ignition in Blast-Furnace Slag Cements. A sample is ignited in a covered crucible at 950-1000 deg. C. for approximately two hours and the SO_3 content of the ignited cement determined. The resulting value is subtracted from the SO_3 content on the unignited material, thus obtaining the amount of oxygen absorbed during ignition, which amounts to about 80% of the difference. This value is added to the loss sustained by ignition.—*Revue des Materiaux de Construction et de Travaux-Publics* (1927), 236-237.

Rapid Determination of CaO in Raw Meal Slag Mixtures. The sample is calcined in a muffle kiln at 1100 deg. C. and the residue dissolved in normal hydrochloric acid. The solution is then diluted with water, boiled for one minute and titrated against sodium hydroxide, with methyl orange.—*Revue des Materiaux de Construction et de Travaux-Publics* (1927), 322.

Electrical Method for Measuring the Setting Time of Portland Cement. Y. Shimizu (Sci. Rep. Tohoku Imp. Univ., 1928, **17**, 85-92).—On measuring the electrical conductivity of gaged cement during setting and hardening, the specimen being maintained at constant temperature, the resistance suddenly changed at the moment corresponding to the final set, as defined by the maximum temperature change. The change in resistance is used to determine the time of setting, the mixed cement being contained in a small tube in a thermostat; two platinum electrodes are immersed in the cement and connected to a Kohlrausch alternating current bridge. The rate of setting and hardening is influenced greatly by temperature, but the method is considered better adapted and more accurate than the mechanical and thermal methods.—*British Chemical Abstract* (May 25, 1928).

High Test Cement Hardening in Ice Water. In connection with the investigations of H. Kuehl (*Zement*, No. 31, 1927) in regard to the behavior of portland and alumina cements when deposited in ice water, H. Vierheller has conducted experiments with alumina cement and found that this can be used for concrete even at the lowest temperatures. With fused alumina cement there does not appear, in the mortar itself and not even in the plastic state, a noteworthy retardation of the setting process because of low temperature. The mass of concrete has therefore no time to cool and it is warmed, as soon as setting has started, from the inside in such a manner that the hydration can proceed unretarded. Whereas high-test portland cement shows, after 3 days of deposit in ice water, a tensile strength of only 8.6 kg. per sq. cm. (122.3 lb. per sq. in.) and a compressive strength of only 74 kg. per sq. cm. (1001 lb. per sq. in.), the fused alumina cement had after 2 days of deposit in ice water a tensile strength of 21.8 kg. per sq. cm. (310 lb. per sq. in.) and a compressive strength of 413 kg. per sq. cm. (5874 lb. per sq. in.).—*Zement*, No. 23 (1928), pp. 892-894.

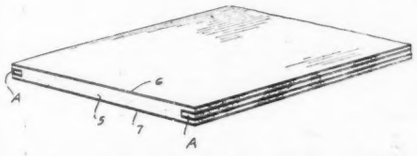
Production of Phosphorus and Aluminous Cement. I. G. Farbenind. A.-G. (B. P. 287,036, 2.2.28. Ger., 19.3.27.)—A mixture of bauxite, rich in iron, and lime in the proportion of 70-90 parts of alumina to 30-10 parts of lime is fused under reduc-

ing conditions in an electric or shaft furnace, and the easily fusible, almost iron-free slag obtained is then fused under reducing conditions with crude phosphates.—*British Chemical Abstracts* (May 25, 1928).

Recent Process Patents

The following brief abstracts are of current process patents issued by the U. S. Patent Office, Washington, D. C. Complete copies may be obtained by sending 10c to the Superintendent of Documents, Government Printing Office, Washington, for each patent desired.

Reinforced-Edge Plaster Board. A plaster core wall board, sheathed with paper on top and bottom and having an insert of a similar plaster-board edging extending longitudinally as illustrated for the purpose



A plaster board with an insert on the edges as a protection

of protecting the edges of the board during handling. In the illustration A represents the plaster core inserts, 5 the composition core, and 6 and 7 the paper sheathing. In manufacture it is suggested that the inserts be imbedded in the core 5 while the latter is still in a "green" state. *John Schumacher, U. S. Patent No.* 1,672,097.

Production of Alkali-Metal Compounds From Silicates in Which They Are Contained. The invention relates to a method of leaching silicates of the potassium-bearing rocks or minerals, such as feldspar and potash slates. Also, the process covers recovery of lithium as a soluble lithium salt from spodumene, and lepidolite by the same procedure. The process consists of pulverizing the mineral to extreme fineness and leaching with milk of lime for 40 to 60 days, holding the temperature of the mixture at 170 deg. to 180 deg. F. The inventor proposes to use equal parts of lime and mineral by weight and to cover the surface of the leach liquors with an oil to prevent carbonation of the lime and the alkali hydrate resulting from the leaching reactions.

Included in the patent is described a leaching tank for treating these minerals and also is outlined a method of removing leach liquors, subjecting the residue to a head of water and removing the entrained soluble salts by displacement. The details of this tank and method of washing are covered by this patent.—*T. A. Edison, assignor to Thomas A. Edison Corp., July* 24, 1928, No. 1,678,246.

Base Powder for Waterproofing, etc., and Process of Producing the Same. A process of producing a powder for use as a base in waterproofing, bonding, cementing, painting, and allied operations. Bituminous material is refrigerated to brittleness or pulverable viscosity and then ground to a powder and mixed with a colloidal material.—*R. R. Cone, assignor, Asphalt Products Co., Inc., U. S. Patent No.* 1,670,844.

Process of and Apparatus for Mixing and Applying Mortar. The apparatus consists of an airtight, cylindrical container for the storage of mortar. Provision is made for an outlet conduit at the bottom of the vessel and a compressed air inlet. A vertical shaft inside of the vessel has rotary extruding blades at the bottom which when operated force mortar into the delivery conduit.—*Horatio W. Brown, assignor, Bemis Industries, Inc., U. S. Patent No.* 1,670,677.

Mechanism for Handling Building Blocks and the Like. An apparatus consisting of a combination of conveyors, a kiln car and drier, designed for the automatic handling of building blocks or bricks, particularly after they have gone through the drier.—*Halver R. Straight, U. S. Patent No.* 1,650,053.

Process of Producing Artificial Stone. Precast stone is frequently cast in a sand mold, which owing to its power of absorbing water, tends to wash the fine particles of cementing material to the surface of the cast. This high cement content of the face of the cast forms a skin that is tough and hard and which, if left on the stone, checks and cracks so it is the usual practice to remove this coating. To overcome this objection and to produce a variety of textured and colored stones, the patent calls for the waterproofing of the sand mold face with a paraffin-kerosene emulsion or other suitable waterproofing compound. This waterproofing agent is sprayed or spattered on the face of the mold and prevents any migration of the cementatious material to the surface. Variations of this principal are used to produce textured and colored stone.—*Frederic M. Emerson, assignor to Emerson and Norris Co., U. S. Paient No.* 1,681,727.

Method and Apparatus for Sintering. This invention covers a method and apparatus for sintering elements which contain a natural combustible material or with which coal or coke has been mixed for combustion purposes. The machine is so designed and operated that the gases of initial combustion are kept separate from the gases formed by the later sintering operation, this separation being sometimes desirable where the gases from the calcining charge are wanted in high concentrations. Means are provided for preventing dilution of these gases by air infiltrations.—*Henry J. Stehli, U. S. Patent No.* 1,680,345.

A Process of Hydrating Lime and Lime Putty. The patent describes a method of slacking lime, preparing putty and a method of storing ready mixed mortar. The process consists of dropping finely divided lime through converging sheets of water, agitating the mixture in a special log washer type agitator, to break up and slake the larger lumps and holding the mixture in specially designed curing drums. The lime putty, while in the curing vats, is drained of its surplus water and additional water passed through the mass to complete the slaking.

The hydrator consists of a hopper (Fig. 1) with gate (C^4) for controlling the amount of lime. Water is introduced through pipe (C^5) which is provided with horizontal slots (C^{10}) for projecting a sheet of water through

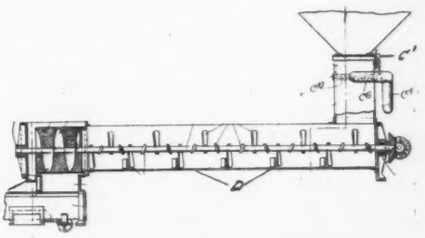


Fig. 1. The complete equipment for a new process of hydrating lime

which the lime passes. The mixed mass drops into the longitudinal mixing chamber (D) provided with paddle agitators for mixing and conveying of the hydrate. At the end of the pug mill is a cylindrical screen through which the lime is forced by a short spiral type conveyor, after which the hydrate or milk of lime passes to curing tanks.

Fig. 2 shows one of the several types of curing tanks. The hopper is provided with a vertical worm (H^{10}) permanently attached to the bottom of the cone, which discharges the material through the spout (H^{12}).—*C. P. Berg, July* 31, 1928, No. 1,679,149.

Launder. The patent describes a launder for use in carrying abrasive material and consists of a wood trough, the sides of which are lined with thin metal. Extending transversely across the unlined bottom of the launder are fastened a number of wooden cleats spaced at frequent intervals. The face of the cleat is protected by sheet metal of sufficient height to project upwardly beyond the cleat. These riffles fill with sand and act as a wearing surface.—*Dawson Henry Needham, Paul Pearson and William Henry Dawson,* June 26, 1928, No. 1,674,789.

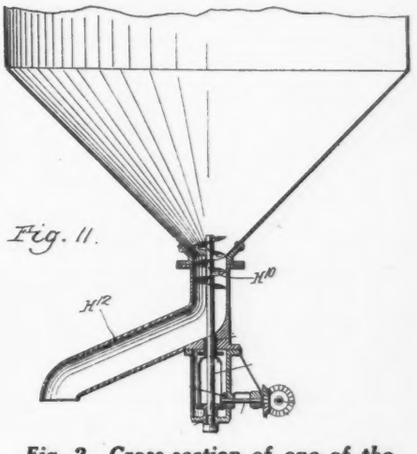


Fig. 2. Cross-section of one of the curing tanks of the new hydrator

Portland Cement Production in August

Shipments Were 2.6% Above Those of August, 1927—Makes Up for Setback in June

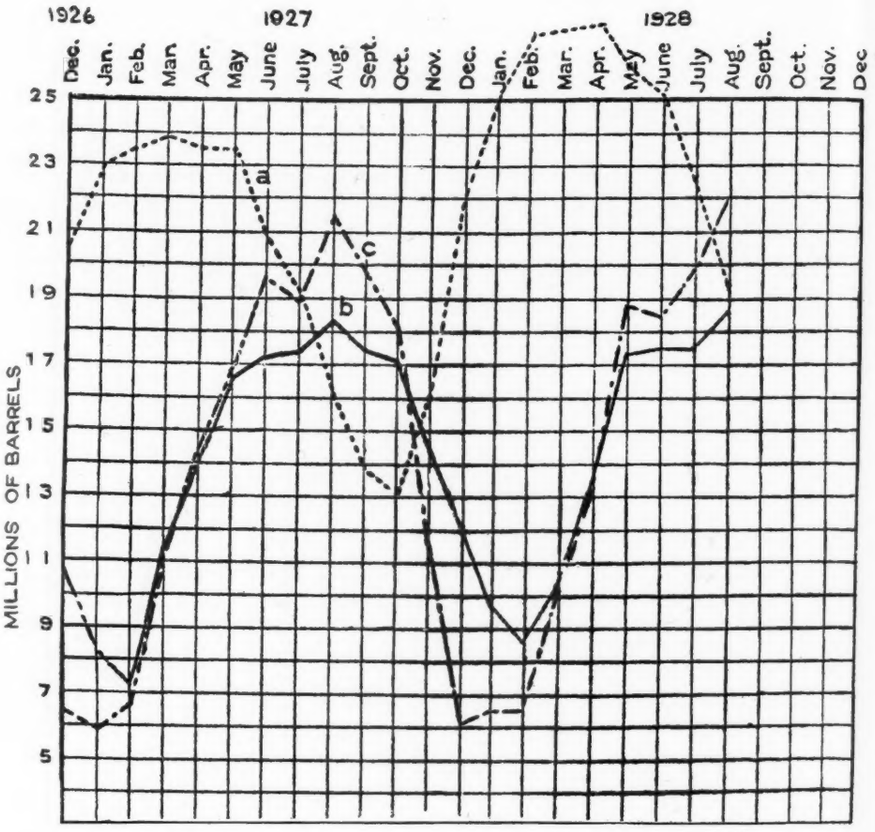
THE PORTLAND CEMENT INDUSTRY in August, 1928, produced 18,730,000 bbl., shipped 21,970,000 bbl. from the mills and had in stock at the end of the month 19,340,000 bbl., according to the United States Bureau of Mines, Department of Commerce. The production of portland cement in August, 1928, showed an increase of 2.3% and shipments an increase of 2.6%, as compared with August, 1927. Portland cement stocks at the mills were 18.7% higher than a year ago. The total production from January to August, 1928, inclusive, amounts to 113,180,000 bbl., compared with 110,781,000 bbl. in the same period of 1927, and the total shipments from January to August, 1928, inclusive, amount to 115,824,000 bbl., compared with 115,170,000 bbl. in the same period of 1927.

The output of another new plant, located in Pennsylvania, is included in the statistics here presented, which are compiled from reports for August from all manufacturing plants except two, for which estimates have been included in lieu of actual returns.

In the following statement of relation of production to capacity the total output of finished cement is compared with the estimated capacity of 159 plants at the close of Aug., 1928, and of 150 plants of Aug., 1927.

RELATION OF PRODUCTION TO CAPACITY

	Aug. 1928 Pct.	Aug. 1927 Pct.	July 1928 Pct.	June 1928 Pct.	May 1928 Pct.
The month	93.1	94.5	87.0	90.1	86.6
12 months ended	73.5	74.0	73.7	73.8	73.9



(a) Stocks of finished portland cement at factories; (b) Production of finished portland cement; (c) Shipments of finished portland cement from factories

PRODUCTION AND STOCKS OF CLINKER, BY MONTHS, IN 1927 AND 1928 (IN BARRELS)

Month	Production 1927	Production 1928	Stock end of month 1927	Stock end of month 1928	Month	Production 1927	Production 1928	Stock end of month 1927	Stock end of month 1928
January	10,410,000	11,839,000	9,989,000	9,672,000	July	15,697,000	*15,981,000	9,609,000	*11,707,000
February	9,253,000	11,363,000	11,943,000	12,237,000	August	16,396,000	16,202,000	7,887,000	9,347,000
March	12,397,000	12,501,000	12,997,000	14,463,000	September	15,931,000	.....	6,490,000	.....
April	14,246,000	13,844,000	13,335,000	15,002,000	October	16,469,000	.....	**5,960,000**	.....
May	15,677,000	16,025,000	12,514,000	*14,329,000	November	14,698,000	.....	6,374,000	.....
June	15,437,000	*15,940,000	10,926,000	12,944,000	December	13,177,000	.....	7,660,000	.....

*Revised. †Maine began producing April, 1928, and shipping May, 1928.

PORTLAND CEMENT SHIPPED FROM MILLS INTO STATES IN JUNE AND JULY, 1927, AND 1928, IN BARRELS*

Shipped to	1927—June—1928		1927—July—1928		Shipped to	1927—June—1928		1927—July—1928	
Alabama	155,252	218,443	207,386	267,843	New Jersey	944,454	836,204	844,190	861,340
Alaska	1,823	1,179	2,029	1,496	New Mexico	21,991	32,989	18,160	36,795
Arizona	45,172	45,357	38,125	42,336	New York	2,869,955	2,369,486	2,467,699	2,480,799
Arkansas	77,555	94,530	72,502	123,490	North Carolina	325,413	253,034	321,348	221,912
California	1,153,990	1,135,923	1,077,710	1,081,470	North Dakota	74,012	89,107	71,813	72,490
Colorado	95,029	134,040	113,490	113,414	Ohio	1,309,273	1,111,149	1,166,296	1,313,568
Connecticut	255,970	274,577	258,232	266,888	Oklahoma	266,615	271,078	287,638	285,643
Delaware	32,807	31,076	18,765	35,077	Oregon	172,173	132,565	187,401	140,619
District of Columbia	87,224	77,565	105,400	87,606	Pennsylvania	1,719,593	1,303,841	1,573,559	1,437,571
Florida	199,406	101,132	166,647	97,376	Porto Rico	1,750	.....	3,000	.....
Georgia	196,027	151,318	179,713	135,770	Rhode Island	68,486	81,651	69,599	68,980
Hawaii	31,227	19,441	34,500	21,832	South Carolina	64,616	174,819	63,414	149,917
Idaho	29,085	31,940	28,166	40,823	South Dakota	54,405	81,989	50,896	61,429
Illinois	1,921,502	1,921,820	1,962,942	2,321,485	Tennessee	219,588	231,638	269,184	288,860
Indiana	739,188	513,118	771,651	712,107	Texas	419,994	563,118	436,475	601,154
Iowa	553,469	790,414	486,109	783,528	Utah	40,344	50,931	41,478	58,462
Kansas	243,653	203,747	263,430	215,125	Vermont	42,594	67,482	45,365	64,211
Kentucky	201,477	155,438	239,555	192,746	Virginia	204,817	198,998	195,133	183,762
Louisiana	119,191	107,624	147,449	113,049	Washington	295,426	342,740	299,400	361,159
Maine	67,820	69,190	82,034	63,915	West Virginia	170,166	126,545	194,693	151,406
Maryland	245,061	240,228	272,142	246,605	Wisconsin	869,960	728,674	858,526	812,237
Massachusetts	320,541	314,595	290,232	334,822	Wyoming	25,173	22,174	20,374	21,154
Michigan	1,504,877	1,393,059	1,360,516	1,540,219	Unspecified	16,202	36,666	29,843	2,209
Minnesota	485,312	490,086	419,976	435,564		19,713,410	18,353,730	18,948,355	19,841,130
Mississippi	76,227	90,654	102,252	90,937	Foreign countries	47,590	67,270	35,645	59,870
Missouri	438,193	388,090	481,281	484,207					
Montana	33,243	57,263	39,521	58,225	Total shipped from cement plants	19,761,000	18,421,000	18,984,000	†19,901,000
Nebraska	145,564	132,088	150,181	110,938					
Nevada	12,853	10,583	10,139	10,535					
New Hampshire	47,672	52,334	50,796	46,025					

*Includes estimated distribution of shipments from three plants each month. †Revised.

PRODUCTION, SHIPMENTS AND STOCKS OF FINISHED PORTLAND CEMENT, BY DISTRICTS, IN AUGUST, 1927 AND 1928, AND STOCKS IN JULY, 1928 (IN BARRELS)

District	Production 1927—Aug.—	1928	Shipments 1927—Aug.—	1928	Stocks at end of month 1927	1928	Stocks at end of July 1928*
Eastern Penn., N.J. and Md.	4,255,000	4,015,000	4,484,000	4,403,000	4,007,000	5,524,000	5,913,000
New York and Maine†	1,348,000	1,320,000	1,514,000	1,519,000	1,365,000	1,423,000	1,622,000
Ohio, West'n Penn., W.Va.	1,967,000	2,038,000	2,489,000	2,687,000	2,284,000	2,447,000	3,096,000
Michigan	1,661,000	1,614,000	2,146,000	2,070,000	1,257,000	1,293,000	1,748,000
Wis., Ill., Ind. and Ky.	2,492,000	2,537,000	3,119,000	3,076,000	1,231,000	1,967,000	2,506,000
Va., Tenn., Ala., Ga., Fla. and La.	1,522,000	1,508,000	1,628,000	1,699,000	1,145,000	1,676,000	1,867,000
East'n Mo., Ia., Minn. and So. Dak.	1,585,000	1,901,000	2,267,000	2,372,000	1,737,000	2,073,000	2,544,000
West'n Mo., Neb., Kan. and Okla.	943,000	1,181,000	1,149,000	1,312,000	1,466,000	1,238,000	1,370,000
Texas	496,000	519,000	561,000	623,000	251,000	211,000	314,000
Colo., Mont. and Utah	216,000	290,000	293,000	364,000	458,000	382,000	456,000
California	1,399,000	1,288,000	1,306,000	1,294,000	718,000	746,000	752,000
Oregon and Washington	431,000	519,000	455,000	551,000	373,000	360,000	392,000
	18,315,000	18,730,000	21,411,000	21,970,000	16,292,000	19,340,000	22,580,000

PRODUCTION, SHIPMENTS AND STOCKS OF FINISHED PORTLAND CEMENT, BY MONTHS, IN 1927 AND 1928 (IN BARRELS)

Month	1927—Production—1928		1927—Shipments—1928		Stocks at end of month 1927	1928
January	8,258,000	9,768,000	5,968,000	6,541,000	22,914,000	25,116,000
February	7,377,000	8,797,000	6,731,000	6,563,000	23,563,000	27,349,000
March	11,450,000	10,223,000	11,100,000	10,135,000	23,922,000	27,445,000
April	14,048,000	13,468,000	14,350,000	13,307,000	23,654,000	27,627,000
May	16,701,000	17,280,000	16,865,000	18,986,000	23,503,000	*25,984,000
June	17,224,000	17,469,000	19,761,000	18,421,000	20,972,000	*25,029,000
July	17,408,000	*17,445,000	18,984,000	*19,901,000	19,397,000	*22,580,000
August	17,315,000	18,730,000	21,411,000	21,970,000	16,292,000	19,340,000
September	17,505,000	.....	19,828,000	.....	13,996,000	.....
October	17,174,000	.....	18,105,000	.....	13,141,000	.....
November	14,449,000	.....	11,619,000	.....	16,022,000	.....
December	11,999,000	.....	6,200,000	.....	22,082,000	.....
	171,908,000	.....	170,922,000	.....	.....	.....

PRODUCTION AND STOCKS OF CLINKER (UNGROUND CEMENT), BY DISTRICTS, IN AUGUST, 1927 AND 1928 (IN BARRELS)

District	1927—Production—1928		Stocks at end of month 1927	1928
Eastern Pennsylvania, New Jersey and Maryland	3,967,000	3,680,000	974,000	1,561,000
New York and Maine†	1,251,000	1,146,000	344,000	799,000
Ohio, Western Pennsylvania and West Virginia	1,689,000	1,632,000	855,000	1,274,000
Michigan	1,352,000	1,305,000	984,000	1,057,000
Wisconsin, Illinois, Indiana and Kentucky	2,114,000	2,014,000	720,000	631,000
Virginia, Tenn., Ala., Ga., Fla. and La.	1,434,000	1,375,000	704,000	848,000
Eastern Missouri, Iowa, Minnesota and S. Dak.	1,486,000	1,694,000	515,000	626,000
Western Missouri, Nebraska, Kansas and Okla.	891,000	1,089,000	413,000	496,000
Texas	462,000	539,000	180,000	128,000
Colorado, Montana and Utah	169,000	220,000	493,000	303,000
California	1,292,000	1,106,000	1,332,000	1,193,000
Oregon and Washington	289,000	402,000	373,000	431,000
	16,396,000	16,202,000	7,887,000	9,347,000

Exports and Imports

Compiled from the records of the Bureau of Foreign and Domestic Commerce and subject to revision.

EXPORTS OF HYDRAULIC CEMENT BY COUNTRIES IN JULY, 1928

Exported to	Barrels	Value
Canada	5,114	$ 28,519
Central America	21,869	72,462
Cuba	6,788	19,862
Other West Indies and Bermuda	3,180	7,540
Mexico	6,684	22,438
South America	35,011	110,538
Other countries	5,113	29,696
	83,759	$291,055

IMPORTS OF HYDRAULIC CEMENT BY COUNTRIES AND BY DISTRICTS, IN JULY, 1928

Imported from	District into which imported	Barrels	Value
Belgium	Galveston	9,000	$11,695
	Hawaii	15,000	19,151
	Los Angeles	90	108
	New York	7,500	9,577
	North Carolina	20,907	25,328
	Oregon	3,000	3,588
	South Carolina	32,826	40,350
	Total	88,323	$109,797
Canada	Maine & N. H.	4,875	$10,254
Denmark	Porto Rico	17,695	$28,173
France	New York	500	$1,655
Italy	New York	3	$10
Sweden	New York	1	$8
United K'd'm	New York	1,490	$1,980
	Grand total	112,887	$151,877

DOMESTIC HYDRAULIC CEMENT SHIPPED TO ALASKA, HAWAII AND PORTO RICO, IN JULY, 1928

	Barrels	Value
Alaska	3,170	$ 9,297
Hawaii	21,849	50,441
Porto Rico	7,770	18,963
	32,789	$78,701

H. M. Power To Be in Charge of Cebu Cement Plant

HAROLD M. POWER, superintendent of the Redwood City, Calif., plant of the Pacific Portland Cement Co., has resigned his position to take effect October 1, and will leave this country shortly to take up his new duties as general superintendent of the Cebu Portland Cement Co. at Cebu, Philippine Islands. At the present time Mr. Power is in the East looking over cement equipment and machinery in New York and also in Chicago. He expects to visit a number of the newest and most progressive plants in the eastern section of the country so that he will be familiar with all of the latest developments of the industry when he enters into his new work. After a study of conditions over this section of the country he will return to San Francisco and will sail for the Orient on one of the ships of the Robert Dollar Line on about October 12. Before reaching Cebu he will stop in Japan to visit the Asano company's plants there and to "get acquainted" with his future competitors. He will also visit the important plants in China on the trip.

Mr. Power has been known in the cement industry for many years, having been connected with the Pacific Portland since 1912. He was formerly superintendent of the Mt. Auburn quarries of the company, of the company's plaster plant at Monad House, and, at another date, superintendent of the cement plant at Suisun, Calif. Since 1924 he has been in charge of the Redwood City plant, which he took over during construction, finishing the job and placing it in operation. This plant is a 6000-bbl., wet-process operation.

In Redwood City, Mr. Power has been active in community work, having been director for the past two years of the Chamber of Commerce and a member and director of the local Kiwanis Club. He has been actively interested in the political situation in the town, and also was particularly active in the promotion of the Municipal Harbor of Redwood City. During the World War he received his commission as first lieutenant of the 20th engineers, and later was made captain. He had been recommended for a commission as major, but did not receive this because of the signing of the armistice. Mr. Power was in France for two years during the war, and during his service received a citation from General Pershing.

Before joining the Pacific Portland Cement Co. Mr. Power was superintendent of the gold mine operated by his father, Harold T. Power, a prominent mining man of California. This mine, known as the "Hidden Treasure Gravel Mining Co.," has been in operation for more than 50 years.

When Mr. Power left the Redwood City plant he was presented with a very beautiful wardrobe trunk and a gladstone bag by the men of the plant as an expression of their regard. More than that, he was given a handsome wrist watch engraved with a statement of their friendly feeling.

EXPORTS AND IMPORTS OF HYDRAULIC CEMENT BY MONTHS, IN 1927 AND 1928

Month	1927—Exports—1928 Barrels	Value	Barrels	Value	1927—Imports—1928 Barrels	Value	Barrels	Value
January	75,346	$254,072	56,400	$204,875	193,175	$269,661	234,753	$342,797
February	71,404	233,985	62,828	221,620	130,421	200,680	164,408	217,525
March	67,956	240,165	74,983	265,719	181,145	261,519	235,930	330,074
April	72,383	243,832	61,676	205,882	192,318	313,262	249,458	324,371
May	59,332	205,574	70,173	236,005	178,929	263,618	190,509	256,872
June	69,205	237,281	59,536	201,313	129,111	201,682	266,537	359,637
July	72,337	249,737	83,759	291,055	175,042	249,665	112,887	151,877
August	61,371	209,198	.....	.....	117,605	170,167	.....	.....
September	57,890	207,817	.....	.....	233,066	304,796	.....	.....
October	67,639	230,668	.....	.....	221,274	321,777	.....	.....
November	79,764	257,428	.....	.....	141,485	190,419	.....	.....
December	62,099	226,960	.....	.....	156,609	209,205	.....	.....
	816,726	$2,796,717	.....	.....	2,050,180	$2,956,451	.....	.....

Traffic and Transportation

Car Loadings of Sand and Gravel, Stone and Limestone Flux

THE following are the weekly car loadings of sand and gravel, crushed stone and limestone flux (by railroad districts) as reported by the Car Service Division, American Railway Association, Washington, D. C.:

CAR LOADINGS OF SAND, GRAVEL, STONE AND LIMESTONE FLUX

District	Limestone flux Week ended Aug. 25	Limestone flux Week ended Sept. 1	Sand, stone and gravel Week ended Aug. 25	Sand, stone and gravel Week ended Sept. 1
Eastern	3,823	4,087	18,158	18,900
Allegheny	4,310	4,038	11,084	11,135
Pocahontas	687	604	931	833
Southern	660	575	11,698	12,339
Northwestern	1,818	1,766	9,534	9,502
Central Western	497	601	14,297	12,768
Southwestern	293	389	7,885	7,543
Total	12,088	12,060	73,587	73,020

COMPARATIVE TOTAL LOADINGS, BY DISTRICTS, 1927 AND 1928

District	Limestone Flux Period to Date 1927 Sept. 3	Limestone Flux Period to Date 1928 Sept. 1	Sand, Gravel and Stone Period to Date 1927 Sept. 3	Sand, Gravel and Stone Period to Date 1928 Sept. 1
Eastern	117,760	99,664	349,706	345,983
Allegheny	123,386	114,904	276,186	240,632
Pocahontas	17,821	16,022	31,947	27,676
Southern	19,922	19,683	422,235	365,159
Northwestern	47,382	46,207	243,525	218,287
Central W'n	17,512	14,749	320,586	351,806
Southwestern	11,445	14,216	193,075	209,878
Total	355,228	325,445	1,837,260	1,759,421

COMPARATIVE TOTAL LOADINGS, 1927 AND 1928

	1927	1928
Limestone flux	***355,228***	***325,445***
Sand, stone, gravel	***1,837,260***	***1,759,421***

Proposed Changes in Rates

THE following are the lastest proposed changes in freight rates up to the week beginning September 22:

SOUTHERN FREIGHT ASSOCIATION DOCKET

41806. **Sand, gravel, crushed stone, etc.,** from Marianna, Fla., to Dothan, Ala. It is proposed to establish rate of 85c per net ton on sand, gravel, crushed stone, slag, rubble stone, broken stone and chert, in straight or mixed carloads (See Note 3), from and to points named above, made on basis of Docket 17517 scale for the joint distance. It is further proposed to amend Agent Glenn's Freight Tariff 88A, I. C. C. A655, by providing for application of trunk line joint scale (Scale 2) rates between L. & N. R. R. stations, Marianna to Cottondale, Fla., inclusive, on the one hand, and A. & St. A. B. Ry. stations, Cottondale, Fla., to Dothan, Ala., on the other.

41818. **Sand, gravel, crushed stone, etc.,** from and to points on the Carolina Southern R. R., carload minimum weight. It is proposed to amend Agent Glenn's Sand and Gravel Tariff, I. C. C. A-655, Agent Cottrell's North Carolina Joint Tariff, I. C. C. 710, and Carolina Southern R. R. Local Tariff, I. C. C. No. 3, by providing the following minimum weight on sand, gravel, crushed stone, etc., from and to points on the Carolina Southern R. R. in lieu of that at present applicable. "Minimum weight 90% of marked capacity of car, but not exceeding 100,000 lb., except when cars are loaded to their visible capacity and weight is less than 100,000 lb. the actual weight will govern."

41881. **Sand and gravel** from Johnsonville, Tenn., to Ripley, Tenn. Combinations now apply. Proposed rate on sand and gravel, carloads (See Note 3), from Johnsonville, Tenn., to Ripley, Tenn., 135c per net ton, made in line with rates that have been established between other southern points, distance considered.

NEW ENGLAND FREIGHT ASSOCIATION DOCKET

15280. **Common sand and gravel,** carloads (See Note 3), from Boston and Topsfield, Mass., to Waterbury, Vt., $1.85 per net ton. Reason—To accord shippers a rate comparable with other rates now in effect.

723-1. To cancel commodity rates on **crushed or ground limestone** from New England port cities to destinations in New England territory, as there are no importations of such commodities.

Note 1—Minimum weight marked capacity of car.
Note 2—Minimum weight 90% of marked capacity of car.
Note 3—Minimum weight 90% of marked capacity of car, except that when car is loaded to visible capacity the actual weight will apply.

ILLINOIS FREIGHT ASSOCIATION DOCKET

4574, Sub. 2. **Blast, engine, foundry, glass and molding sand** (See Note 1), from Bowes, Ill., to Peoria, Ill. Present, class; proposed, $1.76 per net ton.

4651. **Stone,** from Krause, Valmeyer, Falling Springs, Columbia and Stolle, Ill., to various points in Illinois on the N. Y. C. & St. L. Ry.

To representative points—	From Krause, Ill. —A— Pre.	Pro.	—B— Pre.	Pro.	Valmeyer, Ill. —A— Pre.	Pro.
Kaufman, Ill.	98	86	90	96	106	94
Panama, Ill.	107	86	90	86	115	94
Ramsay, Ill.	111	98	103	98	119	106
Kingman, Ill.	113	111	113	111	129	119

Proposed rates from Falling Springs to be 10c per ton less than proposed rates from Krause, Ill. Proposed rates from Columbia and Stolle, Ill., to be the same as the proposed rates from Krause. Column "A"—Stone, viz.: Stone, ground or pulverized (in bulk), crushed or rough quarried, in straight or mixed carloads. Column "B"—Agricultural screenings or dust (fertilizer limestone) ground sufficiently fine so as to be suitable for acid soil treatment.

3561. **Sand,** carloads (See Note 1), from Vandalia, Ill., to New Orleans, La. Present rate, 57c per 100 lb.; proposed, $3.10 per ton of 2000 lb. Proportional rate applicable on shipments originating beyond Vandalia.

3561, Sub. 1. **Sand,** carloads (See Note 1), from Vandalia, Ill., to Birmingham, Ala. Present rate, 57c per 100 lb.; proposed, $3.10 per net ton, proportional rate applicable on shipments originating beyond Vandalia.

CENTRAL FREIGHT ASSOCIATION DOCKET

19509. To establish on **sand and gravel,** carloads (See Note 3), Howard, Ohio, to newark, Ohio, 70c per ton of 2000 lb. Present rate—90c per ton of 2000 lb.

19512. To establish on **crushed stone,** carloads, Keeport, Ind., to Urbana, Ind., 92c per net ton. Present rate—$1.04 per net ton. Route—Wabash Ry., Wabash, Ind., and C. C. C. & St. L. Ry.

19523. To establish on **sand and gravel,** carloads (See Note 3), Kern, Ind., to stations on the Illinois Terminal Co. shown below. Illustration:

(In cents per net ton)

To—	Proposed
Bondville, Ill.	98
Clark, Ill.	98
Cerro Gordo, Ill.	98
Condit, Ill.	98
Long Point, Ill.	98
Ennis, Ill.	98
Turney, Ill.	101
Martin, Ill.	101
Clinton, Ill.	101
Bloomington, Ill.	101

19534. To establish on **crushed stone,** carloads (See Note 3), Marblehead, Ohio, to South Haven, Mich., 165c per net ton. Present rate—Classification basis. Route—Via N. Y. C.-P. M. and N. Y. C.-P. M.

19535. To establish on **crushed stone,** in bulk, in open cars, and **crushed stone screenings,** in bulk, in open cars, carloads (See Note 3), Kenneth, Ind., to Santa Fe, Ind., via C. & O. Ry., 80c per net ton. Present rate—127c per net ton.

19543. To establish on **sand** (except blast, core engine, filter, fire or furnace, foundry, glass, grinding or polishing, loam, molding or silica) and **gravel** (See note 3), Ft. Harrison and South Terre Haute, Ind., to Bradshaw, Ind., 50c per net ton. Present rate—63c per net ton.

19544. To establish on **crushed stone,** carloads (See Note 3), from East Liberty, Ohio . In cents per net ton.

To—	Proposed	Present	Route
Black Run, Ohio	100	*	†
Frabeysburg, Ohio	100	*	†
Unionville, Ohio	90	*	†

*Class. †N. Y. C.-P. R. R.

19549. To establish on **sand** (other than blast, core, engine, filter, fire or furnace, foundry, glass, grinding or polishing, loam, molding or silica) and **gravel,** carloads (See Note 3), Beaver, Penn., to East Palestine, Ohio, 70c per ton of 2000 lb. Present rate, 90c per ton of 2000 lb.

19550. To establish on **sand, viz., blast, core, engine, fire or furnace, glass, grinding or polishing, loam, molding or silica,** carloads (See Note 3), from the so-called Zanesville group to Carpentersville, Ill., 302c per ton of 2000 lb. Present rate, sixth class.

19556. To establish on **sand and gravel,** carloads (See Note 3).

To—	From Dresden, O. Pres.	Ellis, O. Pres.	Gilbert, O. Pres.	Gilbert, O. Pro.
Frazeysburg, O.	70	70	70	60
Black Run, O.	70	70	70	60
Hanover, O.	....	....	....	60
Conesville, O.	....	....	....	60
Coshocton, O.	70	70	70	60
W. Lafayette, O.	....	....	....	70
Uhrichsville, O.	80	80	80	85
Dennison, O.	80	80	80	85
Scio, O.	*140	*140	*140	95
Jewett, O.	*140	*140	*140	95
Cadiz, O.	*140	*140	*140	100
Broadacre, O.	*140	*140	*140	100
Dover, O.	90	90	90	85
Valley Jct., O.	*120	*120	*120	90
Walhonding, O.	....	....	....	70
Brink Haven, O.	*90	†90	*90	80
New Comerston, O.	80	80	80	75

*Rate on gravel, 110c. †Rate on gravel, 80c.

19568. To establish on **crushed stone,** carloads (See Note 3), from North Baltimore, Ohio, to B. & O. R. R. stations shown below:

To—	Present	Proposed
Cambridge, O.	(1) 20	(2) 145
Lore City, O.	(1) 20	(2) 145
Gibson, O.	(1) 20	(2) 145
Quaker City, O.	(1) 20	(2) 155
Barnesville, O.	(1) 20	(2) 155
Bethesda, O.	(1) 20	(2) 155
Lamira, O.	(1) 20	(2) 155
Warnock, O.	(1) 20	(2) 165
Stewartsville, O.	(1) 20	(2) 165
Neffs, O.	(1) 20	(2) 165
Bellaire, O.	(1) 20	(2) 165

(1) Class rates in cents per 100 lb.
(2) Rates in cents per ton of 2000 lb.

WESTERN TRUNK LINE DOCKET

2812B. **Sand, lake,** east of Chicago (See Note 3); west of Chicago (See Note 2), except when weight of shipment loaded to full visible capacity of car is less than 90% of marked capacity of car the actual weight will be the minimum weight. In no case shall the minimum weight be less than 40,000 lb., from Willow Creek, Ind., to Steelton,

Minn. Present rate, Chicago combination, 63c per ton to Chicago, plus 14½c per 100 lb., or $2.90 per ton, beyond; proposed, $2.53 per ton.

2556-J. **Sand,** carloads (See Note 2), except that when weight of shipment loaded to full visible capacity of car is less than 90% of marked capacity of car the actual weight will be the minimum weight. In no case shall the minimum weight be less than 40,000 lb, from Bay City, Wis., to Milwaukee, Wis. Present rate, 9½c per 100 lb. ($1.90 per net ton); proposed, $1.40 per net ton.

TRUNK LINE ASSOCIATION DOCKET

19561. **Crushed stone,** carloads (See Note 2), from Port Richmond (Philadelphia), Penn., to Petersburg, N. J., $1.15 per ton of 2000 lb. Reason—Proposed rate is comparable with rates on like commodities from and to points in the same general territory.

19562. **Sand** (other than blast, engine, foundry, glass, molding, sea or silica) and **gravel,** carloads (See Note 2), from Otisville, N. Y., to Hancock, N. Y., to Mast Hope, Penn., inclusive, $1.10 per ton of 2000 lb. Reason—Proposed rate is fairly comparable with rate now in force from Hamilton, N. Y., to Cadosia, N. Y.

19570. To cancel rates on **sand and gravel,** carloads (See Note 2), from Eder, Jackson, Md., and Newark, Del., to Philadelphia, Birdell, Harrisburg, Tamaqua, Penn., Osborne, Md., Kiamensi, Del., etc., as published in Items 960A and 965B of B. & O. I. C. C. 21139 and Items Nos. 815A, 820A and 845A of B. & O. I. C. C. 21064, classification basis to apply. Reason—Investigation developed there has been no movement for some time and no prospects of future movements, therefore rates obsolete.

Asks Investigation of Crushed Stone Rates from Cumberland, Maryland

SHIPMENTS of sand and crushed stone from Cumberland, Md., to destinations in Maryland, Pennsylvania and West Virginia, west of Cumberland, are subjected to the payment of unreasonable rates by the Baltimore and Ohio railroad, according to arguments presented to the commission by the Cumberland Cement and Supply Co. The rates were said to be preferential of Pittsburgh territory when compared with rates contemporaneously maintained from this section to the same destinations.

Virginia Producers Protest Stone Rate Increase

EASTERN producers of crushed limestone, principally located in Pennsylvania and points in West Virginia, have made a request for an advance of 60 cents on the ton crushed limestone from points in southwest Virginia to Norfolk, and it is understood that producers of southwest Virginia are fighting the increase. The present rate is $2.02 per ton.

The rate case is confined to intrastate schedules, which gives the Virginia state corporation commission the jurisdiction, it is said. Fields Graybeal, owner of the Blue Grass Lime Co., and the largest manufacturer of limestone west of the Blue Ridge, said recently that should the advance in freight rates be granted his mill would be crippled practically 50% and that the other manufacturers in Virginia would suffer a like loss.

A meeting took place recently in Washington, D. C., of limestone producers at which time plans were formed for meeting the request for the advance in freight rates, with committees named to further handle the matter.—*Bluefield* (W. Va.) *Telegraph.*

I. C. C. Orders Suspension of Increase on Stone Rate in Pennsylvania

BY an order entered September 17 in Investigation and Suspension Docket No. 3169, the Interstate Commerce Commission suspended from September 19, 1928, until April 19, 1929, the operation of certain schedules as published in Supplement No. 5 to Pittsburgh and Lake Erie Railroad Co.'s tariff I. C. C. No. 2866, the commission has just announced. The announcement follows in full text:

The suspended schedules propose to increase the rates on stone, broken, crushed and screenings (including crushed limestone and limestone screenings), carloads, from Hillsvale, Penn., and related points to desinations in Ohio, Pennsylvania and West Virginia.

The following is illustrative: From Hillsville, Penn., rates in cents per 2000 lb. Stone, broken, crushed and screenings (including crushed limestone and limestone screenings). (The figures are respectively the present and proposed rates):

To Benwood, W. Va., 115c and 130c; Bridgeport, Ohio, 115c and 130c; Leckrone, Penn., 130c and 140c; Washington, Penn., 115c and 120c.

I. C. C. Decisions

17517. Sand and Gravel to Florida. Rates on sand, gravel (washed or unwashed) and clay gravel from Birmingham, Ensley, Bessemer, Oxmoor, and Alabama City, Ala., to destinations in the Florida peninsula south of the Seaboard Air Line from Jacksonville to River Jct., and from points in Georgia to the Florida peninsula, are, and in the future will be, unreasonable to the extent that they exceed, or may exceed, rates determined by the application of the basic distance scales of rates set forth in the original of these proceedings to the entire distance plus arbitraries in cents per ton for both single-line and joint-line application.

18303. Sand Rates. Rates on sand from Price, Okla., to destinations in Missouri were found not unreasonable nor unduly prejudicial. Rates from Price to Baxter, Columbus, Cherokee and Parsons, Kan., were unduly prejudicial, and to Neodesha and Humboldt, Kan., unduly prejudicial and unreasonable to the extent that they exceeded or might exceed 7 cents. The rates to Baxter, Columbus, Cherokee, Parsons, Neodesha and Humboldt were unduly prejudicial to the extent that they had exceeded, exceeded, or might exceed rates contemporaneously in effect from the Kansas City, Mo.-Kan., district to the same destinations. Reparation awarded to Humboldt.

18162. Crushed Stone. Rates on crushed stone moving on government and on commercial account over an interstate route from Franklin, Tenn., to Brownsville, Stanton and Keeling, Tenn., not unreasonable. Complaint ordered dismissed.

18144. Cement. Rate charged on a carload of cement shipped from York, Penn., to Shreveport, La., in 1924, applicable and not unreasonable. Complaint ordered dismissed.

19927. Crushed Stone. Rates charged on crushed stone from Linwood, Iowa, to Mapleton, Ill., in 1924, not applicable and reparation awarded. The commission has found the applicable rate to be $1.21 per net ton.

19651. Ground Limestone. The applicable rate on ground limestone from Sparta, Tenn., to Paulsboro, N. J., was unreasonable but not unduly prejudiced, to the extent it exceeded $7.48 per long ton, minimum weight 30 net tons. Reparation with interest was awarded. Commission also found that the collection of outstanding undercharges might be waived.

18988. Lime Rate. Rate on lime, in carloads, from Milltown, Ind., to California, Ohio (a suburb of Cincinnati), found unreasonable to the extent it exceeds the applicable contemporaneous rate from Mitchell, Ind., to California, Ohio, by more than 1 cent per 100 lb. and unduly preferential of competition of the complainant (Louisville Cement Co.) at Mitchell. The undue prejudice has been removed.

19726. Molding Sand. Rates not unreasonable on molding sand from Camden, Tenn., to Detroit and Pontiac, Mich.

19086. Silica Sand Import Rates. Import rates on silica sand from San Pedro, Wilmington and East Torrance, Calif., to Los Angeles, Long Beach and Torrance, Calif., applicable to the shipments in question and not unreasonable. Handling charge on this traffic at San Pedro not unreasonable.

19650. Crushed Stone. Rates on crushed stone from Atlas, Ky., were unreasonable to the extent they exceeded $1.80 to Clifton, Mason City and Hartford, W. Va., and exceeded $1.90 to New Haven and Graham, W. Va. Present applicable rates unreasonable to the extent they exceed the rate of $1.70 to Clifton, Mason City, Hartford and New Haven, and $1.80 to Graham, the subsequently established rates. Reparation awarded to the Olive Hill Limestone Co., Inc.

19362. Sand and Gravel Rates. Rates on sand and gravel from Barrett and Spur 311, Minn., to Wyndmere, Adams, Vesta and Nekoma, N. D., found unreasonable to the extent that they exceeded 4.5, 6, 6 and 6.5 cents to Wyndmere, Vesta, Adams and Nekoma respectively. Reparation awarded.

19188. Sand Combination Rate. Combination rate on sand from Keithley's Spur, Neb., to Minneapolis, Kan., found applicable and case dismissed.

Pacific Rock and Gravel Co.'s New Plant Under Construction

THE FIRST PIECE OF EQUIPMENT arrived at the Pacific Rock and Gravel Co.'s property in Centerville, Calif., recently. The locomotive crane was unloaded and assembled for the purpose of digging the foundation of the $250,000 plant.

Construction work was ordered August 22 at a meeting of the board of directors and work will now be carried to completion. The first work to be done by the crane is to dig foundations 27 ft. deep, 40 ft. wide and 138 ft. long.

The board of directors for the new plant anounced recently are: President, Lee A. Frontz of Niles; vice-president and general manager, Martin Uldall of San Francisco, president of Standard Gypsum Co.; E. W. Burr, member of the advisory board of the Bank of Italy at Hayward; F. A. MacHugh of Oakland, who arranged the financing; P. H. Hoare of Hayward, road contractor and rancher; F. E. Leach of Oakland, formerly of the Eden Creamery at Hayward, and Judge C. H. Sooy of San Francisco, director of the Pacific National Bank.

Fred J. Bodinson, president of the Bodinson Manufacturing Co., who has the contract for the new gravel plant, announces that it will be in operation before January 1.

Financing is about concluded with a number of representative material users and business men of San Francisco, Oakland, as well as the local investors.—*Niles* (Calif.) *Register.*

Developing Kansas Asphaltic Sandstone Deposits

EXPERIMENTS with a new crushing machine designed especially to pulverize the rock asphalt being taken from a pit a half mile north of Deerfield, and 10 miles east of Fort Scott, Kan., are held up, pending the arrival of some new parts designed to give effectiveness to the machinery.

The development of this bed of rock asphalt by the company now interested in it depends upon a satisfactory process of pulverizing the rock. No stock machine will do it. The rock so gums up a rock crusher as to render it useless. The machine now on the ground is one designed particularly for the work, and a large pile of the asphalt, crushed into small, sand-like particles, now stands before the machine, testifying to the promise of success. But some of the parts of the machine wore so rapidly in the operation that it became necessary to make some changes, which are now being awaited.

A pit of the asphalt rock has been stripped of its 10-ft. overburden, just south of the Marmaton river bridge, north of Deerfield. Men are now engaged there quarrying, under the foremanship of George McLaughlin. It is blasted out and is being broken and stored near the crusher. The average depth of the vein is about 10 ft., and it is estimated there are 15,000,000 tons of it on the 80-acre lease on which the pit is being operated.

The rock is a dark sandstone. Broken, it discloses a black surface, and it smells strongly of oil or asphalt. Extensive prospecting has resulted in finding no other deposit of the rock containing so favorable constituents as this particular deposit. Some of it has too much volatile matter in it. From some too much of the oil has been drained by nature in ages past. The crushed stone seems quite impervious to water. It was reported that in prospecting with core drills the oil or asphalt in the stone oozes into the drill hole, dulls the drill, renders necessary extraordinary methods and slows up the drilling considerably.

Laboratory tests and experiments are going on continually to determine the exact possibilities of the rock. The promoters of this project seem to fully expect to produce the rock ready to apply cold, by mere pressure on streets as paving—exactly similar to the way Kentucky asphalt is applied. Under test on National avenue at the court house and on Highway 54 through Deerfield it has shown a durability that is said to tend to prove its worth as a paving material.

J. G. Herring of the Silica Sand Co. at Ottawa, Ill., is interested.—*Fort Scott* (Kan.) *Tribune.*

Ohio Finishing Lime Association Prepares Lime Code

THE Finishing Lime Association of Ohio has recently issued a booklet concerning the classification of lime, together with a code of ethics and marketing policies of the members of the association.

The formation of a code of ethics and marketing policies is a result of a consciousness on the part of the members of the Finishing Lime Association of Ohio, that the sale and distribution of building supplies represent the most intense competitive field that exists in our commercial life today. Further, the members realize that if the present system of distribution is to survive, that the dealer must have a fair return of profit upon his investment, and the formation of the Finishing Lime Association and the inauguration of marketing policies mentioned above represent their efforts to bring about a spirit of fair play and cooperation.

The association is made up of the leading manufacturers of finishing hydrated lime from Ohio, and one of the requirements for membership is that the manufacturers' product meet the current specifications of the American Society for Testing Materials.

The Gibsonburg Lime Products Company of Gibsonburg, Ohio, has recently become a member of the association, and operate a modern lime plant at Gibsonburg, Ohio. This addition to the association membership strengthens it, and it is now one of the most highly organized industries serving the construction field.

The membership is as follows: The Kelley Island Lime & Transport Co., Cleveland, Ohio; the Luckey Lime & Supply Co., Luckey, Ohio; the National Lime & Stone Co., Findlay, Ohio; the National Mortar & Supply Co., Pittsburgh, Penn.; the Ohio Hydrate & Supply Co., Woodville, Ohio; the Woodville Lime Products Co., Toledo, Ohio, and the Gibsonburg Lime Products Co., Gibsonburg, Ohio.

Illinois Sand and Gravel Men Meet and Play Golf

THE president of the Illinois Sand and Gravel Association, O. J. Ellingen of H. D. Conkey & Company, Mendota, Ill., and the secretary, R. E. Weaver of the Lincoln Sand & Gravel Co., Lincoln, Ill., had a unique idea in staging a business and golf meeting for the members of the Illinois Association, which was held at the Lincoln Country Club in Lincoln on Wednesday, September 12th.

The business meeting was held in the morning and the golf game after luncheon. Sand and gravel men from thirty companies were present for the day's golf outing. It was decided to spend a day on the Mississippi river next month, when the association meets at Alton.

President Ellingen took the prize for the largest distance obtained, and J. P. Cantlon of Mattoon, Ill., had low medal score.

Canadian Phosphate Resources To Be Developed

LOOKING FORWARD to the day when British Columbia will supply Canada's great prairie grain belt with the fertilizers necessary to maintain the present richness of its soil, the Consolidated Mining and Smelting Co. has moved here to secure permanent rights to vast phosphate deposits in the Fernie district of British Columbia. The company, it was announced at the mines department recently, is acquiring leases to cover 40 square miles of territory on the Elk river, not far from Fernie, where phosphates can be recovered in enormous quantities and manufactured into fertilizer.

Behind this move is a scheme of national importance, in effect the restocking of Canada's richest agricultural areas, which cannot go on producing grain year after year without the use of fertilizer in quantities not used anywhere in the world yet. In securing control of deposits from which this fertilizer can be manufactured, the Consolidated is looking to the future when the prairie farmer will have to renew his soil with some economic form of fertilizer not obtainable on a big scale at present.—*Vancouver* (B. C.) *Province.*

Cement Products

TRADE MARK REGISTERED WITH U. S. PATENT OFFICE

A Concrete Products Business Built on "Quick, Dependable Service"

Producing the Best Quality Catch Basin Blocks and Manhole Units Is the Object of the Stone, Brick and Block Works of Chicago

By T. A. Day
Cement Products Bureau, Portland Cement Association

THAT the success of the concrete products business depends largely upon the economic manufacture of quality products and a system of aggressive merchandising is evidenced by the enviable record of the Stone, Brick and Block Works, one of the leaders in the concrete manhole and catch basin block industry in the Chicago territory.

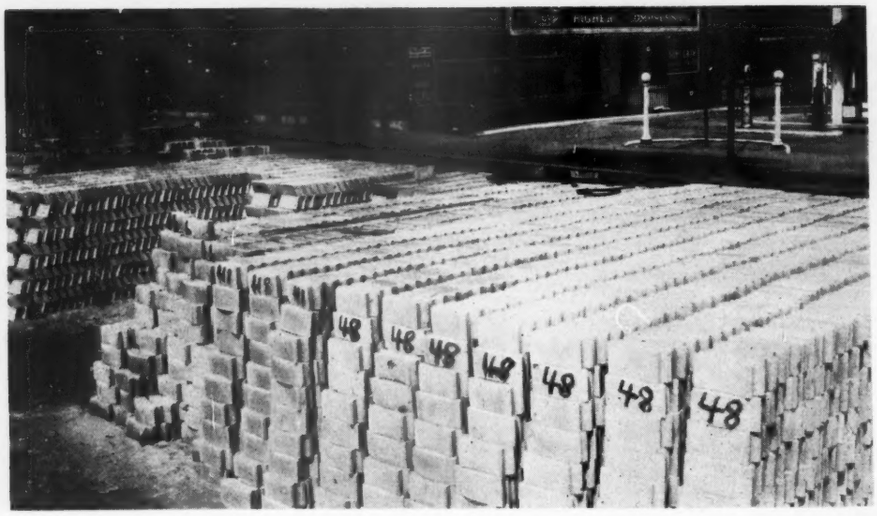
Purchasing a struggling plant in August, 1923, Paul E. Scott, president and general manager of the Stone, Brick and Block Works, in five years' time has developed the business to the extent that over 600,000 radial units and approximately 10,000 catch basin covers will be merchandised this year. It is interesting to note that the cardinal points of merchandising—advertising, selling and service—have guided him at all times. In fact, he says, "My success can be attributed to quick, dependable service and high quality products."

This company manufactures units of high strength and low absorption, gives customers prompt deliveries, supervises construction so that sewer structures are built properly and gives engineers and contractors accurate price quotations. In addition, Mr. Scott maintains an efficient engineering department to furnish technical information, blueprints, estimates, plans and bidding data.

Operating about four months in 1923 and 10 months in 1924, the plant produced about 175,000 units. Some concrete building block and brick were manufactured during this time, but Mr. Scott was beginning to concentrate on one line of products—manhole and catch basin block. In 1925 all lines except manhole unit catch basin block and catch basin covers were discontinued. That year nearly 300,000 units were marketed, while in 1926, the last year in which products were made in hand-operated molds, the annual output was increased to 375,000. It was at the end of 1926 that Mr. Scott decided, after making an extensive survey of machine-equipped plants, to install power equipment. Machine-made radial concrete block were made in this plant for the first time in April, 1927, with the production jumping to over 500,000 as a result. In addition, over 9000 concrete catch basin covers were sold that year.

Ever since he entered the products business Mr. Scott has concentrated on *selling* and *service*. Practically all sewer contractors within 50 miles of Chicago, the territory which he serves regularly, know him, refer to him as "Scotty," and use his manhole and catch basin block extensively. He has built up an enviable reputation for good products and dependable service. When the Stone, Brick and Block Works contracts to furnish block for a sewer job the sewer builders never have to wait for units and never have to go to a far corner of the lot to get the block. They are always at hand, having been delivered to the site of the manhole or catch basin. "Keep ahead of the sewer

Laying up the first course of batter block in a 36-in. concrete block manhole in Chicago. The second course of batter block will reduce the inside diameter to the required 24 in.



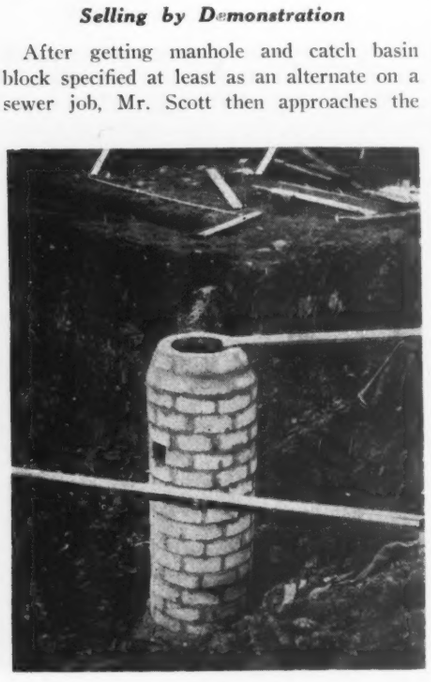
The yard of the Stone, Brick and Block Works with a pile of block for 48-in. manholes, showing the uniformity of the units

building crew," orders Mr. Scott and his employes always follow out his instructions.

Unusual as it may seem, Mr. Scott frequently walks into offices of well-known engineers carrying a manhole block under one arm and a heavy hammer in one hand. In his inside coat pocket can be found current reports of tests for compressive strength and absorption made by reliable testing laboratories. If these reports are not sufficient to satisfy skeptical engineers, he makes the "hammer test." A well-made, well-cured concrete product can stand considerable hammering, as those familiar with the industry well know, and this test often clinches a sale.

Selling by Demonstration

After getting manhole and catch basin block specified at least as an alternate on a sewer job, Mr. Scott then approaches the contractor. If this contractor has once used products of the Stone, Brick and Block Works the selling task is usually an easy one. If he has not made use of them, it is general practice for Mr. Scott to give him enough block to build an average sized manhole. This enterprising products man then supervises the construction of a sample manhole, keeping accurate cost figures on labor and mortar. He then has the contractor build the same sized structure of common brick and records the same of costs. The result is invariably the same—about 60% saving in labor and from 60 to 80% saving in mortar.

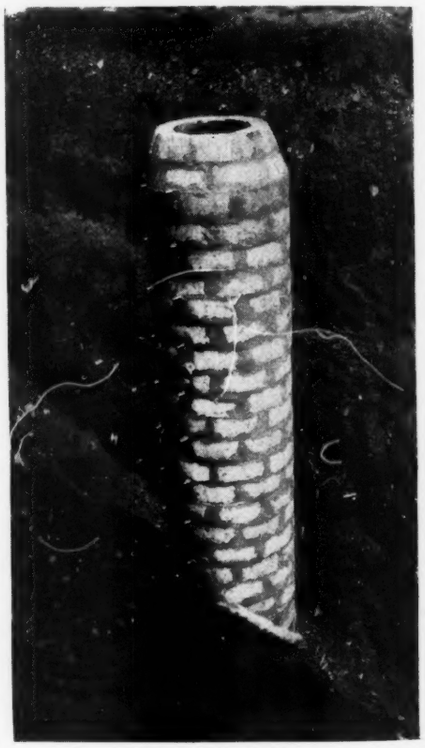


A 36-in. block manhole built several years ago at Ivanhoe, Ill., with some of the first units furnished by the company

Mr. Scott's merchandising efforts have been so successful that he has supplied thousands of block for building sewer appurtenances in the streets of the city of Chicago, as well as for the south parks, Lincoln park and the west parks commissions of that city. Countless units have also gone into catch basins for private homes. Towns and villages outside of Chicago which have used his products or are using them at present include Evanston, Winnetka, Tessville, Elmwood Park, Villa Park, Lombard, Bellwood, Westchester, Broadview, Riverside, Berwyn, Lyons, Summit, Argo, Clearing, Hazel Crest, Harvey, Specialville, Ivanhoe, Riverdale, Dolton, Thornton, South Holland, Calumet City and Lansing. The business of the Stone, Brick and Block Works is by no means confined to the state of Illinois. Cities and towns in Indiana, including Gary, East Gary, Hobart, Hammond, Munster, Rensselaer, Crown Point and Michigan City, have used, and some of them are now using, manhole and catch basin block furnished by Mr. Scott.

Incidentally, it is interesting to note the opinion of W. P. Cottingham, city engineer of Gary, Ind., regarding concrete manhole and catch basin block. He states: "I am very glad to advise that we have in Gary been using concrete block for the construction of manholes in our sewer work during the past 18 months and have been very well satisfied with the results obtained. . . . Structurally, I feel that the concrete block manhole is superior to the manholes heretofore built out of common brick. And I am doing everything possible to encourage continued use of this product."

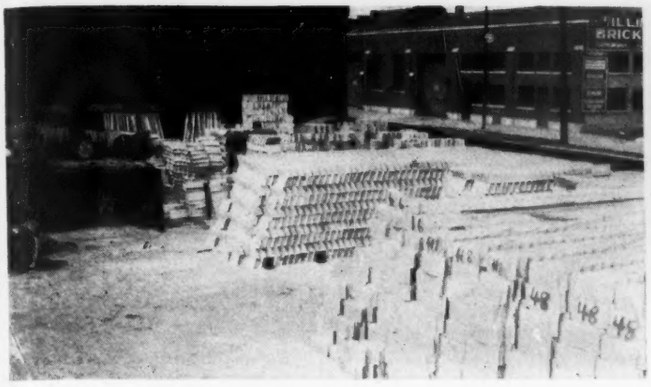
While the advertising done by the Stone, Brick and Block Works is not as extensive as that usually done by the up-to-date products manufacturer, it has been very effective nevertheless. Printed pamphlets, blueprints, reports of tests, statements of engineers and contractors are used regularly in selling the customer. However, Mr. Scott believes that a well-built manhole constructed of high quality concrete block is as good an advertisement medium as he could use. It is not uncommon for him to take engineers and contractors on inspection trips to sewer jobs where his products are being used.



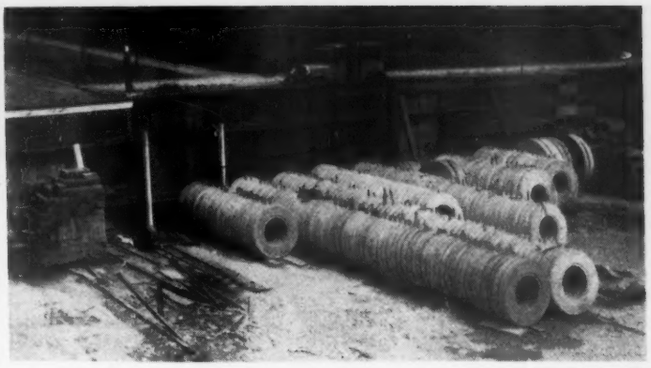
Concrete block manhole 26 ft. deep recently completed in Grant Park, Chicago

The plant of the Stone, Brick and Block Works occupies a tract of land, 200 ft. wide and 150 ft. deep, leased for the purpose at the intersection of Michigan avenue and 63rd street, Chicago. It is adjacent to the New York Central tracks, included as part of the Chicago switching district. Of the 30,000 sq. ft. of land available, the factory occupies about 5000 sq. ft., while the remainder is used for storage space. Ordinarily a stock of at least 50,000 block and 500 catch basin covers are on hand at all times.

The plant equipment consists of one power tamper and a stripper machine equipped with interchangeable mold boxes to make 30-, 36-,



The storage yard of the Stone, Brick and Block Works showing a number of different types of units



Concrete catch basin covers ready for installation, at the yard of the Stone, Brick and Block Works

42- or 48-in. manhole or catch basin block; one 14-ft. dump bottom power mixer to furnish concrete for these products; one continuous power mixer to furnish concrete for batter block; one portable mixer to furnish concrete for catch basin covers; five lift-trucks; 85 racks for handling block; 40 platforms for handling basin covers; one low pressure boiler to furnish wet steam for the six curing rooms which have a total capacity of 4000 units; five electric motors and the necessary shafting and belting.

The Supply of Aggregate

Aggregates and cement are delivered in carload lots over a spur track on the property, the limestone screenings that are used being shipped to the plant from the quarries at LaGrange, Ill. One main storage bin, having a capacity of five carloads, is filled from the cars by means of a portable conveyor. An overhead storage bin, which is filled by an elevator, is used to supply aggregate for the mixers. Cement is stored on a platform of one car capacity inside the plant within easy reach of the mixer man.

The Stone, Brick and Block Works usually employs 16 men, including the plant superintendent and the bookkeeper. Two men handle aggregate and cement when delivered, keep the overhead bin filled with limestone screenings and at other times manufacture concrete catch basin covers. One employe operates the continuous and batch mixers simultaneously, three operate the stripper machine and convey "green" units to the curing chambers, six work in the yard and handle shipping and two make batter block in the hand-operated molds.

Although the company owns and operates a fleet of five trucks, it is often necessary to hire trucks to deliver block. Mr. Scott states that this practice is more economical than owning and operating a fleet large enough to serve his purpose. On particularly muddy jobs, where trucks cannot make deliveries directly to the manhole or catch basin sites, teamsters are hired to place the units at the right locations.

Products, as already indicated, with the exception of catch basin covers which are made by the wet cast method, are power tamped. They are cured at a temperature ranging from 13 deg. F. to 140 deg. F. in steam curing tunnels for at least 24 hours. Then they are allowed to air-cure in the storage yard for at least seven days before being delivered upon construction work.

In one of the publications issued by the Stone, Brick and Block Works can be found this statement: "The use of concrete block for sewerage systems has proven satisfactory and profitable to drainage engineers, sewer builders and contractors for private and municipal sewer construction, as evidenced by the ever increasing demand for our products. Our efforts are directed to the upbuilding of the concrete products industry and to the manufacture of the highest quality block."

In conclusion, it is only fitting to say that the Stone, Brick and Block Works has a very well-trained group of employes. The plant has been closed down during January and February of each year since its organization, but when it is opened each spring the same employes go back to their respective jobs. Mr. Scott pays the men adequate wages so that they can prepare for the annual layoff, finding that he gains their loyalty and complete co-operation as a result.

Cement Products in Canada in 1927

CEMENT products made in Canada reached a new high level in 1927 at $2,663,065. This output represented an increase of 5% over the $2,544,242 in 1926, which in turn was 26% over the production value of $2,020,239 reported for 1925.

A total of 151 plants were engaged in this line of manufacture in 1927; 109 were located in Ontario, 31 in Quebec, 5 in British Columbia, 2 in Nova Scotia, 2 in Saskatchewan and one each in New Brunswick and Alberta. These concerns represented a capital investment of $2,671,273, paid out $936,053 in salaries and wages, and by manufacturing process added $1,750,379 to the value of purchased materials which cost $912,686 delivered at the works.

New Cast Stone Plant To Be Erected in Tuscaloosa

PLANS for the erection of a $15,000 plant for the manufacture of artificial stone are under way at Tuscaloosa, Ala., according to an announcement from Frank Curry, of the Frank Curry Co., of that city.

The first unit will occupy a floor space of approximately 10,000 square feet and will be constructed entirely of stone. The site has not yet been selected, but the company is negotiating for a lot on one of the trunk lines of railroads running into Tuscaloosa. Construction of the building will be started within the next three weeks, it was stated. This will open up a new industry for Tuscaloosa and promises to be a profitable venture. —*Birmingham* (Ala.) *News.*

Hollow Block for Foundations Banned by Borough of Queens, New York City

THE use of hollow building blocks for the construction of house foundations underneath the ground surface has been banned in the Borough of Queens, City of New York, by Superintendent of Buildings Charles Bales at the direction of Borough President Patten, and in the future solid building blocks must be used.

Although the building code specifies that where hollow blocks are used in foundation work they must be filled with concrete, it has been learned that in many cases these cavities have been filled with sand or not filled at all when a building inspector was not present.

"The Building Bureau has 45 inspectors to cover the whole borough with an area of 117 square miles," Mr. Patten said. "In order to have hollow blocks properly filled after they are laid it would be necessary to put an inspector at every job and keep him there until the foundation is completed. That, of course, is impossible with only 45 inspectors. The only sure way of having the work done properly is to have the blocks solid before they are put in place."—*New York* (N. Y.) *Times.*

The Rock Products Market

Wholesale Prices of Crushed Stone

Prices given are per ton, F.O.B., at producing point or nearest shipping point

Crushed Limestone

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
EASTERN:						
Buffalo, N. Y.	1.30	1.30	1.30	1.30	1.30	1.30
Chaumont, N. Y.	.50	1.75	1.75	1.50	1.50	1.50
Chazy, N. Y.	.75	1.75	1.60	1.30	1.30	1.30
Dundas, Ont.	.53	1.05	1.05	.90	.90	.90
Farmington, Conn.	.....	1.30	1.10	1.00	1.00	.....
Frederick, Md.	.50@ .75	1.35@1.45	1.15@1.25	1.10@1.20	1.05@1.15	1.05@1.10
Ft. Spring, W. Va.	.40	1.35	1.30	1.25	1.20	.....
Munns, N. Y.	.75	1.40	1.30	1.25	1.00	.....
Prospect, N. Y.	1.00	1.40	1.25	1.25	1.25	.....
Rochester, N. Y.—Dolomite	1.50	1.50	1.50	1.50	1.50	1.50
St. Vincent de Paul, Que. (n)	.....	1.35	1.15	.95	.90	1.20
Walford, Penn.	.....	.....	1.35h	1.35h	1.35h	1.35h
Watertown, N. Y.	1.00	1.75	1.75	1.50	1.50	1.50
Western New York	.85	1.25	1.25	1.25	1.25	1.25
CENTRAL:						
Afton, Mich.	.....	.....	.....	.....	.50	1.50
Alton, Ill.	1.85	.....	1.85	.....	.....	.....
Columbia and Krause, Ill.	1.05@1.40	.95@1.50	1.15@1.50	1.05@1.50	1.05@1.50	.....
Cypress, Ill.	1.00@1.25	1.00@1.25	1.20@1.25	1.20@1.25	1.20@1.25	1.35
Davenport, Iowa	1.00	1.50	1.50	1.30	1.30	1.40
Dubuque, Iowa	.85	1.00	1.25	1.25	1.25	1.25
Stolle and Falling Springs, Ill.	1.05@1.40	.95@1.50	1.15@1.50	1.05@1.50	1.05@1.50	.....
Greencastle, Ind.	1.25	1.05	1.05	1.05	.95	.95
Lannon, Wis.	1.00	1.00	1.00	.90	.90	.90
McCook, Ill.	1.00	1.25	1.25	1.25	1.25	1.25
Marblehead, Ohio (l)	.55	.80	.80	.80	.80	.80
Milltown, Ind.	.....	.90@1.00	1.00@1.10	.90@1.00	.85@ .90	.85@ .90
Northern Ohio Points	.85@1.15	1.25	1.15	1.15	1.15	1.15
Sheboygan, Wis.	1.10	1.10	1.10	1.10	1.10	1.10
Stone City, Iowa	.75	.....	1.20	1.00	1.00	.....
Thornton, Ill.	.90	1.00	1.25	1.25	1.25	1.25
Toledo, Ohio	1.60	1.70	1.70	1.60	1.60	1.60
Toronto, Canada (m)	2.50	3.00	3.00	2.85	2.85	2.85
Valmeyer, Ill. (fluxing limestone)	.90@1.20	.....	.....	1.75	.....	1.75
Waukesha, Wis.	1.00	1.10	.90	.90	.90	.....
Winona, Minn.	1.00	1.20	1.30	1.40	1.40	1.40
Wisconsin Points	.50	.....	1.00	.90	.90	.....
Youngstown, Ohio	.70j	1.25l@1.35h	1.25l@1.35h	1.25l@1.35h	1.25l@1.35h	1.25l@1.35h
SOUTHERN:						
Cartersville, Ga.	1.20	1.65	1.65	1.45	1.15	1.15
Chico, Texas	1.00	1.30	1.25	1.20	1.10	1.05
Cutler, Fla.	.40r@ .75r	.....	.....	1.75r	.....	1.10r
El Paso, Tex.	.50@ .75	.....	1.25	1.00	1.00	1.00
Graystone, Ala.	Crusher run, screened, $1 per ton					
Kendrick and Santos, Fla.	3½ in. and less, $1 per ton					
Olive Hill, Ky.	.....	1.00@1.10	.90@1.00	.90@1.00	.90	.90
Rocky Point, Va.	.50@ .75	1.40@1.60	1.30@1.40	1.15@1.25	1.10@1.20	1.00@1.05
WESTERN:						
Atchison, Kan.	.50	1.80	1.80	1.80	1.80	1.80
Blue Springs & Wymore, Neb.	.25	1.45	1.45	1.35c	1.25d	1.20
Cape Girardeau, Mo.	1.25	.....	1.25	1.25	1.00	.....
Rock Hill, St. Louis, Mo.	1.00	1.15@1.25	1.15@1.25	.90@1.20	.90@1.20	.90@1.20
Sugar Creek, Mo.	.75	1.00	1.20	1.20	1.20	1.20

(r) Cubic yard.

Crushed Trap Rock

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
Birdsboro, Penn. (q)	1.20	1.60	1.45	1.35	.....	1.30
Branford, Conn.	.80	1.70	1.45	1.20	1.05	.....
Eastern Maryland	1.00	1.60	1.60	1.50	1.35	1.35
Eastern Massachusetts	.85	1.75	1.75	1.25	1.25	1.25
Eastern New York	.75	1.25	1.25	1.25	1.25	1.25
Eastern Pennsylvania	1.10	1.70	1.60	1.50	1.35	1.35
Knippa, Tex.	2.50	2.25	1.75	1.25	1.25	1.25
New Britain, Plainville, Rocky Hill, Wallingford, Meridan, Mt. Carmel, Conn.	.80	1.70	1.45	1.20	1.05	.....
Northern New Jersey	1.40@1.45	2.00@2.10	1.80@1.90	1.40@1.50	1.40@1.50	.....
Richmond, Calif.	.75	.....	1.00	1.00	1.00	.....
Spring Valley, Calif.	.90@1.25	.90@1.25	.90@1.25	.90@1.25	.90@1.25	.90@1.25
Springfield, N. J.	.....	2.00	1.90	1.50	1.50	.....
Toronto, Canada (m)	.....	5.80	.....	4.05	.....	.....
Westfield, Mass.	.60	1.50	1.35	1.20	1.10	.....

Miscellaneous Crushed Stone

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
Berlin, Utley, Montello and Red Granite, Wis.—Granite	1.80	1.70	1.50	1.40	1.40	.....
Cayce, S. C.—Granite	.....	.....	1.75	1.75	1.60	.....
Eastern Penn.—Sandstone	1.35	1.70	1.65	1.40	1.40	1.40
Eastern Penn.—Quartzite	1.20	1.35	1.25	1.20	1.20	1.20
Emathla, Fla.—Flint rock	1.00	.....	2.35	.....	.....	.....
Lithonia, Ga.—Granite	.75a	1.75b	1.75	1.40	1.35	1.25
Lohrville, Wis.—Granite	1.65	1.70	1.65	1.45	1.50	.....
Middlebrook, Mo.	3.00@3.50	.....	2.00@2.25	2.00@2.25	.....	1.25@3.00
Richmond, Calif.—Quartzite	.75	.....	1.00	1.00	1.00	.....
Somerset, Penn. (sand-rock)	.....	.....	1.50 to 1.85	.....	.....	.....
Toccoa, Ga.	.40	1.30	.....	1.25	1.30	1.30

(a) Sand. (b) to ⅛ in. (c) 1 in., 1.40. (d) 2 in., 1.30. (e) Price net after 10c cash discount deducted. (f) 1 in. to ¼ in., 1.45; 2 in. to ½ in., 1.35. High calcite fluxing stone. 1.40. (h) Less 10c discount. (j) Less 10% net ton. (l) Less .05. (m) Plus .25 per ton for winter delivery. (n) Crusher run for ballast, .85. (p) Carload prices. (q) Crusher run, 1.40; ¼-in. granolithic finish, 3.00. (r) Cubic yd.

Agricultural Limestone

(Pulverized)

Alton, Ill.—Analysis, 98% $CaCO_3$, 0.01% $MgCO_3$; 90% thru 100 mesh	4.50
Bettendorf and Moline, Ill.—Analysis, $CaCO_3$, 97%; 2% $MgCO_3$; 50% thru 100 mesh, 1.50; 50% thru 4 mesh	1.50
Blackwater, Mo.—100% thru 4 mesh	1.00
Branchton, Penn.—100% thru 20 mesh; 60% thru 100 mesh; 45% thru 200 mesh	5.00
Cape Girardeau, Mo.—Analysis, $CaCO_3$, 94½%; $MgCO_3$, 3½%; 90% thru 50 mesh	1.50
Cartersville, Ga.—50% thru 50 mesh	1.50
Pulverized, per ton	2.00
Chaumont, N. Y.—Pulverized limestone, bags, 4.00; bulk	2.50
Cypress, Ill.—Analysis, 88% $CaCO_3$; 10% $MgCO_3$; 50-90% thru 4 mesh	1.25
50-90% thru 100 mesh	1.35
Danbury, Conn., and West Stockbridge, Mass.—Analysis, 90% $CaCO_3$; 5% $MgCO_3$; fine ground, 90% thru 100 mesh; bulk	3.50
Paper bags	4.75
100 lb. cloth bags	5.25

(All prices less .25 cash 15 days)

Davenport, Ia.—Analysis, 97% $CaCO_3$; 2% and less $MgCO_3$; 90% thru 200 mesh, bags, per ton	6.00
90% thru 20 mesh, bulk, per ton	1.50
Hillsville, Penn.—Analysis, 94% $CaCO_3$; 1.40% $MgCO_3$; 75% thru 100 mesh; sacked	5.00
Hot Springs and Greensboro, N. C.—Analysis, $CaCO_3$, 98-99%; $MgCO_3$, 42%; pulverized; 67% thru 200 mesh; bags	3.95
Bulk	2.70
Jamesville, N. Y.—Analysis 89% $CaCO_3$, 4% $MgCO_3$; pulverized; bags, 4.25; bulk	2.75
Joliet, Ill.—Analysis, 52% $CaCO_3$; 46% $MgCO_3$; 50% thru 100 mesh	2.50
Knoxville, Tenn.—80% thru 100 mesh; bags, 3.95; bulk	2.70
Marlbrook, Va.—Analysis, 80% $CaCO_3$; 10% $MgCO_3$; bulk	1.75
Marl—Analysis, 95% $CaCO_3$; 0% $MgCO_3$; bulk	2.25
Marion, Va.—Analysis, 90% $CaCO_3$, 2% $MgCO_3$; per ton	2.00
Middlebury, Vt.—Analysis 99.05% $CaCO_3$; 90% thru 50 mesh; bulk, 4.00; paper bags	5.00
Milltown, Ind.—Analysis, 94.50% $CaCO_3$, 33% thru 50 mesh, 40% thru 50 mesh; bulk	1.35@ 1.60
Olive Hill, Ky.—90% thru 4 mesh	1.00
90% thru 100 mesh	2.00
Piqua, Ohio—Total neutralizing power 101.12%; 99% thru 10, 60% thru 50; 45% thru 100	2.50
100% thru 10, 90% thru 50, 70% thru 100; bags, 5.00; bulk	3.50
100% thru 4, 30% thru 100, bulk	1.50
Rocky Point, Va.—Analysis, $CaCO_3$, 97%; $MgCO_3$, 75%; 50% thru 200 mesh, burlap bags, 3.50; paper, 3.25; bulk	2.00
Watertown, N. Y.—Analysis, 96-99% $CaCO_3$; 50% thru 100 mesh; bags, 4.00; bulk	2.50

Agricultural Limestone

(Crushed)

Bedford, Ind.—Analysis, 98% $CaCO_3$; 1%, $MgCO_3$; 95% thru 10 mesh	1.50

(Continued on next page)

Agricultural Limestone

Chico and Bridgeport, Tex. — 50% thru 100 mesh	1.50
Davenport, Ia.—Analysis, 97% $CaCO_3$; 2% and less $MgCO_3$; 90% thru 10 mesh, per ton	1.25
90% thru 4 mesh, per ton	1.10
Dubuque, Iowa—50% thru 4 mesh	.85
Dundas, Ont.—Analysis, 54% $CaCO_3$; $MgCO_3$, 43%; 50% thru 50 mesh	1.00
Ft. Spring, W. Va.—Analysis, 90% $CaCO_3$; 90% thru 50 mesh	1.00
Kansas City, Mo. — 50% thru 100 mesh	1.00
Lannon, Wis.—Analysis, 54% $CaCO_3$, 44% $MgCO_3$; 99% thru 10 mesh; 46% thru 60 mesh	2.00
Screenings (¼ in. to dust)	1.00
Marblehead, Ohio—90% thru 100 mesh	3.00
90% thru 50 mesh	2.00
90% thru 4 mesh	1.00
McCook, Ill.—90% thru 4 mesh	.90
Middlepoint, Bellevue, Bloomville, Kenton and Whitehouse, Ohio; Monroe, Mich.; Bluffton, Greencastle and Logansport, Ind.—85% thru 10 mesh, 20% thru 100 mesh	1.50
Moline, Ill., and Bettendorf, Iowa—Analysis, 97% $CaCO_3$, 2% $MgCO_3$; 50% thru 100 mesh; 50% thru 4 mesh	1.50
Mountville, Va. — Analysis, 76.60% $CaCO_3$; $MgCO_3$, 22.83%, 100% thru 20 mesh; 50% thru 100 mesh, paper bags, 4.50; burlap bags	5.00
Stolle and Falling Springs, Ill.—Analysis, 89.9% $CaCO_3$, 3.8% $MgCO_3$; 90% thru 4 mesh	1.10@1.70
Stone City, Iowa — Analysis, 98% $CaCO_3$; 90% thru 50 mesh	.75
Waukesha, Wis.—90% thru 100 mesh, 4.50; 50% thru 100 mesh	2.05
Valmeyer, Ill.—Analysis, 96% $CaCO_3$, 2% $MgCO_3$; 100% thru 10 mesh	1.10@1.70

Pulverized Limestone for Coal Operators

Davenport, Ia.—Analysis 97% $CaCO_3$; 2% and less $MgCO_3$; 100% thru 20 mesh, 50% thru 200 mesh; paper sacks	6.00
Hillsville, Penn., sacks, 4.50; bulk	3.00
Joliet, Ill. — Analysis, 52% $CaCO_3$; 46% $MgCO_3$; 95% thru 100 mesh; paper bags (bags extra)	3.50
Marblehead, Ohio — Analysis, 83.54% $CaCO_3$; 14.92% $MgCO_3$; 99.8% thru 100 mesh; sacks	4.25
Piqua, Ohio, sacks, 4.50@5.00; bulk	3.00@ 3.50
Rocky Point, Va.—85% thru 200 mesh, bulk	2.25@ 3.50
Waukesha, Wis.—90% thru 100 mesh, bulk	4.50

Glass Sand

Silica sand is quoted washed, dried and screened unless otherwise stated. Prices per ton f.o.b. producing plant.

Cedarville and S. Vineland, N. J.	*1.75@ 2.25
Estill Springs and Sewanee, Tenn.	1.50
Franklin, Penn.	2.00
Klondike, Mo.	2.00
Massillon, Ohio	3.00
Michigan City, Ind.	.30@ .35
Ohlton, Ohio	2.50
Ottawa, Ill.	1.25
Red Wing, Minn.	1.50
Rockwood, Mich.	2.25@ 3.00
San Francisco, Calif.	4.00@ 5.00
Silica and Mendota, Va.	1.75@ 2.00
St. Louis, Mo.	2.00
Utica and Ottawa, Ill.	.75@ 1.00
Zanesville, Ohio	2.50

Miscellaneous Sands

City or shipping point	Roofing sand	Traction
Beach City, Ohio		1.50
Dresden, Ohio		1.25
Eau Claire, Wis.	4.25	
Estill Springs and Sewanee, Tenn.	1.35@1.50	1.35@1.50
Franklin, Penn.		1.75
Massillon, Ohio		2.00
Michigan City, Ind.		.30
Montoursville, Penn.		1.25
Ohlton, Ohio	1.75	1.75
Ottawa, Ill.	3.25	1.25
Red Wing, Minn.		1.00
San Francisco, Calif.	3.50	3.50

(Continued on next page)

Wholesale Prices of Sand and Gravel

Prices given are per ton, F.O.B., producing plant or nearest shipping point

Washed Sand and Gravel

City or shipping point	Fine Sand, 1/10 in. down	Sand, ¼ in. and less	Gravel, ½ in. and less	Gravel, 1 in. and less	Gravel, 1½ in. and less	Gravel, 2 in. and less
EASTERN:						
Asbury Park, Farmingdale, Spring Lake and Wayside, N.J.		.55	1.10	1.25	1.40	
Attica and Franklinville, N. Y.	.75	.75	.85	.75	.75	.65
Boston, Mass.‡	1.40	1.40	2.25		2.25	2.25
Buffalo, N. Y.	1.10	1.05	1.05	1.05	1.05	1.05
Erie, Penn.	.60	.80			1.40	
Leeds Junction, Me.		.50	1.75		1.25	1.00
Machias Jct., N. Y.	.75	.65	.65	.65	.65	.65
Milton, N. H.		.50				.90
Montoursville, Penn.	1.00	.75	.70	.60	.60	.50
Northern New Jersey	.50@ .60	.50@ .60	1.25		1.35	1.25
Somerset, Penn.		2.00				
South Portland, Me.		1.00	2.50		2.25	
Troy, N. Y.	.50@ .75*	.50@ .75*	.80@1.00*	.80@1.00*		.80@1.00*
F. o. b. boat, per yd.	1.50	1.50	1.75	1.75		1.75
Washington, D. C.	.55	.55	1.20	1.20	1.00	1.00
CENTRAL:						
Algonquin, Ill.	.30*	.20*	.30*	.40*	.40*	.45*
Attica, Ind.			All sizes .75@.85			
Aurora, Moronts, Oregon, Sheridan, Yorkville, Ill.	.50	.35	.20	.50	.60	.60
Barton, Wis.		.40	.60	.65	.65	.65
Chicago, Ill.	.50	.50@1.45n	.60	.60@1.55n	.60	.60@1.90n
Chicago, Ill.	.30	.20	.30	.40	.40	.45
Columbus, Ohio¶		.65	.65	.65	.65	
Des Moines, Iowa		.30		1.40	1.40	1.40
Eau Claire, Chippewa Falls, Wis.		.40	.55@ .75	.85	.85	
Elkhart Lake, Wis.	.60	.40	.50	.50	.50	.50
Ferrysburg, Mich.		.50@ .80	.60@1.00	.60@1.00		.50@1.25
Grand Haven, Mich.		.60@ .80	.70@ .90	.70@ .90		.70@ .90
Grand Rapids, Mich.	.50	.50	.90	.80	.70	.70
Hamilton, Ohio		1.00	1.00		1.00	
Hersey, Mich.		.50		.60	.80	.70
Humboldt, Iowa	.35	.35	1.35	1.35	1.35	1.35
Indianapolis, Ind.	.60	.60		.90	.75@1.00	.75@1.00
Mankato, Minn.		.45g		.60@1.25h	.70@1.25	1.25e
Mason City, Iowa	.50	.50	1.25	1.25	1.25	1.25
Mattoon, Ill.			.75@.85 all sizes			
Milwaukee, Wis.	96	.91	1.06	1.06	1.06	1.06
Minneapolis, Minn.	.35p	.35p	1.25q	1.25q	1.25q	1.25q
St. Louis, Mo.	1.15e	1.45f	1.45a	1.45	1.45	1.45
St. Paul, Minn.	.35	.35		1.25	1.25	1.25
Terre Haute, Ind.	.75	.60	.75	.85	.75	.75
Waukesha, Wis.		.45	.60	.60	.65	.65
Winona, Minn.	.40	.40	1.50	1.25	1.10	1.10
SOUTHERN:						
Brewster, Fla.	.50	.50	3.00	3.00		
Brookhaven, Miss.	1.25	.70	1.25	1.00	.70	.70
Charleston, W. Va.			River sand and gravel, all sizes, 1.40			
Eustis, Fla.		.45				
Fort Worth, Tex.	1.10	1.00	1.25	1.10@1.20	1.10	1.10
Knoxville, Tenn.	1.00	1.00	1.20	1.20	1.20	1.20
Macon, Ga.	.65@ .90	.65@ .90	2.25@2.50	2.25@2.50	2.25@2.50	2.25@2.50
New Martinsville, W. Va.	1.10	1.00		1.30	1.10	.90
Roseland, La.	.35	.15	.85	.85	.75	.75
WESTERN:						
Kansas City, Mo.	.70	.70@ .75				
Crushton, Durbin, Kincaid, Largo, Rivas, Calif.	.10@ .40	.10@ .40	.50@1.00	.50@1.00	.50@1.00	.50@1.00
Oregon City, Ore.	1.25*	1.25*	1.25*	1.25*	1.25*	1.25*
Otay, Calif.		.36@ .40	.50@ .60	.50@ .60	.50@ .60	.50@ .60
Phoenix, Ariz. (k)	1.25*	1.15*	1.50*	1.15*	1.15*	1.00*
Pueblo, Colo.	.80	.60		1.20		1.15
Seattle, Wash.	1.25*	1.25*	1.25*	1.25*	1.25*	1.25*
Steilacoom, Wash.	.50	.50	.50	.50	.50	.50

Bank Run Sand and Gravel

City or shipping point	Fine Sand, 1/10 in. down	Sand, ¼ in. and less	Gravel, ½ in. and less	Gravel, 1 in. and less	Gravel, 1½ in. and less	Gravel, 2 in. and less
Algonquin and Beloit, Wis.			.35			
Brookhaven, Miss.						.60
Buffalo, N. Y.	1.10	.95		85		.85
Burnside, Conn.	.75*		1.30	1.10	1.00	1.00
Chicago, Ill.	1.25m			.35		
Des Moines, Iowa				.60		
Dresden, Ohio				.70	.65	
Eau Claire, Chippewa Fls., Wis					.65	
Fort Worth, Texas						.65
Gainesville, Texas						.55
Grand Rapids, Mich.				.50		
Hamilton, Ohio					1.00	
Hersey, Mich.				.50		
Indianapolis, Ind.			Mixed gravel for concrete work, at .65			
Macon, Ga.	.35					
Oregon City, Ore.	1.25*	1.25*	1.25*	1.25*	1.25*	1.25*
Somerset, Penn.		1.85@2.00		1.50@1.75		
Steilacoom, Wash.	.25					
St. Louis, Mo.			Mine run gravel, 1.35 per ton			
Summit Grove, Ind.	.50	.50	.50	.50	.50	.54
Winona, Minn.	.40	.40	.60	.60	.60	.60
York, Penn.	1.10	1.00				

*Cubic yd. ‡Delivered on job by truck. (a) ¾-in. down. (b) River run. (c) 2½-in. and less. ¶By truck only. (d) Delivered in Hartford, Conn., $1.50 per yd. (e) Mississippi River. (f) Meramee River. (g) Washed and screened river sand. (h) ¾-in. to ¾-in. (j) Lake sand, 1.75, delivered. (k) 60-70% crushed boulders. (m) Cu. yd., dune sand, f.o.b. cars, Chicago. (n) Cu. yd., f.o.b. cars, Chicago. (p) .65 cu. yd. (q) $1.75 to $2.00 cu. yd.

Core and Foundry Sands

Silica sand is quoted washed, dried and screened unless otherwise stated. Prices per ton f.o.b. producing plant.

City or shipping point	Molding, fine	Molding, coarse	Molding, brass	Core	Furnace lining	Sand blast	Stone sawing
Albany, N. Y.	2.00	2.00	2.25			3.75	
Beach City, Ohio	1.75@2.00	1.75@2.00		1.50	1.75		1.50
Dresden, Ohio	1.25@1.50	1.25@1.50	1.50@1.75	1.00@1.25			
Eau Claire, Wis.						3.00	
Elco & Tamms, Ill.	Ground silica per ton in carloads—18.00@31.00						
Estill Springs and Sewanee, Tenn.	1.25			1.25		1.35@1.50	
Franklin, Penn.	1.75	1.75	2.00	1.75			
Kasota, Minn.							1.00
Kerrs, Ohio	1.10@1.50	1.25@2.00	2.00			2.75@3.00	
Klondike, Mo.	2.00			2.00			
Massillon, Ohio	2.25	2.25		2.25	2.50		
Michigan City, Ind.				.30@ .35			
Montoursville, Penn.				1.35@1.60			
New Lexington, O.	2.00	1.25					
Ohlton, Ohio	2.00	2.00		1.75	1.75	1.75	
Ottawa, Ill.	1.00	1.25	1.50	1.75	1.25	3.50	2.00
Red Wing, Minn.(d)					1.50	3.00	1.50
San Francisco, Calif.[1]	3.50†	5.00†	3.50†	3.50@5.00†	3.50@5.00†	3.50@5.00†	
Silica, Mendota, Va.	Potters flint, 8.00@10.00g						
Utica & Ottawa, Ill.	.40@1.00f	40.@1.00f	.75@1.00	.40@1.00f	.60@1.00f	2.23@3.25	1.00@3.25
Utica, Ill.	.60	.70		.75	1.00		
Warwick, Ohio	1.50*@2.00h	1.50*@2.00h		1.50*@2.00h			
Zanesville, Ohio	2.00	1.50	2.00	2.50	2.00		

*Green. †Fresh water washed, steam dried. [1]Core, washed and dried. 2.50. (d) Filter sand, 3.00. (e) Filter sand ,$3.00@4.25. (f) Crude and dry. (g) Also 7.00. (h) Washed, 1.75.

Crushed Slag

City or shipping point EASTERN:	Roofing	¼ in. down	½ in. and less	¾ in. and less	1½ in. and less	2½ in. and less	3 in. and larger
Buffalo, N. Y., Erie and Dubois, Pa.	2.25	1.25	1.25	1.35	1.25	1.25	1.25
Eastern Penn.	2.50	1.20	1.50	1.20	1.20	1.20	1.20
Northern N. J.	2.50	1.20	1.50	1.20	1.20	1.20	1.20
Reading, Penn.	2.00	1.00		1.25			
Western Penn.	2.50	1.25	1.50	1.25	1.25	1.25	1.25
CENTRAL:							
Ironton, Ohio		1.30*		1.45*	1.45*	1.45*	
Jackson, Ohio	2.05*	1.05*	1.80*	1.30*	1.05*	1.30*	
Toledo, Ohio	1.50	1.35	1.35	1.35	1.35	1.35	1.35
SOUTHERN:							
Ashland, Ky.	2.05*	1.45*	1.80*	1.45*	1.45*	1.45*	1.45*
Ensley and Alabama City, Ala.	2.05	.55	1.25	1.15	.90	.90	.90
Longdale, Roanoke, Ruesens, Va.	2.50	1.00	1.25	1.25	1.25	1.15	1.15
Woodward, Ala.†	2.05*	.55*		1.15*	.90*	.90*	

5c per ton discount on terms. †1¼ in. to ¼ in., $1.05; ⅝ in. to 10 mesh, $1.25*; ⅝ in. to 0 in., .90*; ¼ in. to 10 mesh, .80*.

Lime Products (Carload Prices Per Ton F.O.B. Shipping Point)

EASTERN:	Finishing hydrate	Masons' hydrate	Agricultural hydrate	Chemical hydrate	Ground burnt lime, Blk.	Ground burnt lime, Bags	Lump lime, Blk.	Lump lime, Bbl.
Berkeley, R. I.			12.00					2.00
Buffalo, N. Y.	11.50	7.50	7.50	12.00	8.00	11.00	7.50	1.50[16]
Lime Ridge, Penn.							5.00	
West Stockbridge, Mass.	12.00	10.00	5.60					2.00[12]
Williamsport, Penn.	10.00@11.00	8.50@9.00	8.50@9.00		7.00	9.00	5.00	
York, Penn., & Oranda, Va.	11.50[7]	8.50@9.50[7]	8.50@9.50[7]	8.50@10.50[7]	8.00	9.25	7.00	1.40[9]
CENTRAL:								
Afton, Mich.						10.00	7.50	
Carey, Ohio	11.50	7.50	7.50		8.00		8.00	1.50
Cold Springs, Ohio		8.00	7.50				8.00	
Gibsonburg, Ohio	11.50				8.00	10.00		
Huntington, Ind.	11.50	7.50	7.50	12.00	8.00	11.00	7.50	1.50[16]
Luckey, Ohio	11.50							
Milltown, Ind.		8.50@10.00		10.00[8]			8.50[22]	1.35[10]
Ohio points	11.50	7.50	7.50	12.00	8.00	11.00	7.50	1.50[16]
Scioto, Ohio	11.50	7.50	7.50	8.50	8.25	.62½	7.00	1.50
Sheboygan, Wis.		10.50					9.50	2.00[4]
Wisconsin points[6]		11.50					9.50	
Woodville, Ohio	11.50	7.50	7.50	12.50	8.00	10.00[9]	8.00	1.50[3]
SOUTHERN:								
El Paso, Texas							7.00	1.50
Frederick, Md.		8.00@9.50	8.00@9.50			9.50[13]	7.00[15]	
Graystone & Landmark, Ala.	12.50	9.00					7.00	1.35
Keystone, Ala.	12.50	9.00	9.00	10.00			8.00	1.35
Knoxville, Tenn.	19.00	9.00	9.00	9.00			7.50	1.35
Ocala, Fla.	14.00	12.00	11.00	13.00			11.00	1.40
WESTERN:								
Kirtland, N. M.							15.00	
Los Angeles, Calif.	15.00	14.00	12.00	18.00			13.50	
San Francisco, Calif.	19.00	17.50	13.00	17.50@19.00	14.50	.90[17]	13.00	1.85[17]
Tehachapi, Calif.[18]	10.80		6.75[11]	12.00			10.30	
Seattle, Wash.	19.00	19.00	12.00	19.00	19.00		18.60	2.30

[1] Barrels. [2] Net ton. [3] Wooden, steel 1.70. [4] Steel; in bbl. .95. [5] Dealers' prices, net 30 days less 25c discount per ton on hydrated lime and 5c per bbl. on lump if paid in 10 days. [7] In paper bags, including bags. [8] To 11.00. [9] 80-lb. [10] To 1.50. [11] Refuse or air slack, 10.00@12.00. [12] To 3.00. [13] Delivered in Southern California. [15] To 8.00. [16] To 1.70. [17] Less credit for return of empties. [22] To 9.00. [20] To 16.50.

Miscellaneous Sands

(Continued)

City or shipping point	Roofing Sand	Traction
Utica & Ottawa, Ill.	1.00@ 3.25	.75
Warwick, Ohio		2.00
Zanesville, Ohio		2.50

*Damp.

Talc

Prices given are per ton f.o.b. (in carload lots only), producing plant, or nearest shipping point.

Chatsworth, Ga.:
- Crude talc (for grinding) 4.00@50.00
- Ground talc (20-50 mesh), bags 8.00
- Ground talc (150-200 mesh), bags 8.50@15.50
- Pencils and steel crayons, gross 1.00@ 2.00

Chester, Vt.:
- Ground talc (150-200 mesh), paper bags 7.50@8.50a
- Same, including 50-lb. bags 8.50@ 9.50

Chicago and Joliet, Ill.:
- Ground (150-200 mesh), bags 30.00

Cromleys Mt., Md.:
- Crude talc 63.00

Dalton, Ga.:
- Crude talc (for grinding) 5.00
- Ground talc (150-200 mesh), bags 12.00
- Pencils and steel worker's crayons, per gross 1.00@ 2.50

Emeryville, N. Y.:
(Double air floated) including bags;
- 325 mesh 14.75
- 200 mesh 13.75

Hailesboro, N. Y.:
- Ground white talc (double and triple air floated) 200-lb. bags, 300-350-mesh 15.50@20.00

Henry, Va.:
- Crude (mine run) 3.50@ 4.00
- Ground talc (150-200 mesh), bags 7.50@14.25

Joliet, Ill.:
- Ground talc (200 mesh) in bags:
- California white 30.00
- Southern white 20.00
- Illinois talc 10.00

Keeler, Calif.:
- Ground (200-300 mesh), bags 20.00@30.00

Natural Bridge, N. Y.:
- Ground talc (300-325 mesh), bags 12.00@15.00

(a) Bags extra.

Rock Phosphate

Prices given are per ton (2240-lb.) f.o.b. producing plant or nearest shipping point.

Lump Rock

- Columbia, Tenn.—B.P.L. 65-70% 3.50@ 4.50
- Gordonsburg, Tenn.—B.P.L. 65-70% 4.25@ 4.75
- Mt. Pleasant, Tenn.—B.P.L. 72% 5.25
- B.P.L. 75% 6.50
- Tennessee — F.o.b. mines, gross ton, unground brown rock, B.P.L. 72% 5.00
- B.P.L. 75% 6.00
- Twomey, Tenn.—B.P.L. 65%, 2000 lb. 8.00@ 9.00

Ground Rock

(2000 lb.)

- Centerville, Tenn.—B.P.L. 65% 8.00
- Gordonsburg, Tenn.—B.P.L. 65% 6.00
- B.P.L. 72% 8.00
- Mt. Pleasant, Tenn.—B.P.L. 72% 9.00
- Twomey, Tenn.—B.P.L. 65% 8.00

Florida Phosphate

(Raw Land Pebble)

(Per Ton)

- Florida — F.o.b mines, gross ton, 68/66% B.P.L., Basis 68% 3.25
- 70% min. B.P.L., Basis 70% 3.75

Mica

Prices given are net, f.o.b. plant or nearest shipping point.

- New York City, N. Y.—Per lb.,
- Cut mica (1½x2) 1.60
- Cut mica (8x10) 26.00
- Pringle, S. D.—Mine run, per ton 125.00
- Punch mica, per lb. .06
- Scrap, per ton, carloads 20.00
- Rumney Depot, N. H.—Per ton,
- Mine run 300.00
- Clean shop scrap 25.00
- Mine scrap 22.50@24.00
- Roofing mica 37.50
- Punch mica, per lb. .12
- Cut mica—50% from Standard List.

Special Aggregates

Prices are per ton f.o.b. quarry or nearest shipping point.

City or shipping point	Terrazzo	Stucco-chips
Brandon, Vt. — English pink, English cream and coral pink	¶12.50@‖14.50	¶12.50@‖14.50
Brighton, Tenn.—Pink marble chips	§3.00	§3.00
Crown Point, N. Y.—Mica spar		9.00@10.00
Davenport, Ia.—White limestone, in bags	6.00	6.00
Easton, Penn.		8.00@ 9.00
Harrisonburg, Va.—Bulk marble (crushed, in bags)	†12.50	†12.50
Ingomar, Ohio—Concrete facings and stucco dash		11.00@18.00
Middlebrook, Mo.—Red		20.00@25.00
Middlebury, Vt.—Middlebury white	¶9.00@‖10.00	¶9.00@‖10.00
Middlebury and Brandon, Vt.—Caststone, per ton, including bags		4.00@ 5.50
Phillipsburg, N. J.—Royal green granite		16.00@20.00a
Randville, Mich.—Crystalite crushed white marble, bulk	4.00	4.00@ 7.00
Rose pink granite, bulk		12.00
Stockton, Calif.—"Natrock" roofing grits		12.00@20.00
Tuckahoe, N. Y.—Tuckahoe white	8.00	
Warren, N. H.		¶7.90@‖8.95
Wauwatosa, Wis.		20.00@32.00
Wellsville, Colo. — Colorado Travertine Stone †C.L. L.C.L. 16.00.	15.00	15.00

§Bulk, car lots, minimum 30 tons. ¶C.L. ‖L.C.L. (a) Including bags.

Potash Feldspar

Auburn and Topsham, Me. — Color white, 98% thru 140-mesh	19.00
Buckingham, Ore.—White, analysis, K_2O, 12-13%; Na_2O, 1.75%; bulk	9.00
De Kalb Jct., N. Y.—Color, white; analysis, K_2O, 9.63%; Na_2O, 1.01%; SiO_2, 69.72%; Fe_2O_3, .00%; Al_2O_3, 18.6%; bulk (crude)	9.00
East Hartford, Conn.—Color, white, 40 mesh to 200 mesh	15.00@28.00
East Liverpool, Ohio—Color, white; 98% thru 200 mesh, bulk	19.35
Soda feldspar, crude, bulk, per ton	22.00
Glen Tay Station, Ont.—Color, red or pink; analysis, K_2O, 12.81%; crude	7.00
Keystone, S. D.—White; bulk (crude)	8.00
Los Angeles, Calif.—Color, white; analysis, K_2O, 12.16%; Na_2O, 1.53%; SiO_2, 65.60%; Fe_2O_3, .10%; Al_2O_3, 19.20%; Arizona spar, crude, bags, 12.50@14.00; bulk	11.00@12.50
Pulverized 95% thru 200 mesh; bags, 19.73@23.50; bulk	15.75@22.50
Pulverized, 20% thru 80 mesh; bags, 17.60; bulk	16.50
Murphysboro, Ill.—Color, prime white; analysis, K_2O, 12.60%; Na_2O, 2.35%; SiO_2, 63%; Fe_2O_3, .06%; Al_2O_3, 18.20%; 98% thru 200 mesh; bags, 21.00; bulk	20.00
Penland, N. C.—White; crude, bulk	8.00
Ground, bulk	16.50
Spruce Pine, N. C.—Color, white; analysis, K_2O, 10%; Na_2O, 3%; SiO_2, 68%; Fe_2O_3, 0.10%; Al_2O_3, 18%; 99½% thru 200 mesh; bulk (Bags 15c extra.)	18.00
Crude feldspar, bulk	9.00
Tenn. Mills—Color, white; analysis K_2O, 10%; Na_2O_3, 3%; 68% SiO_2; 99½% thru 200 mesh; bulk (Bags, 15c extra)	18.00
Toronto, Can.—Color, flesh; analysis K_2O, 12.75%; Na_2O, 1.96%; crude	7.50@ 8.00

Chicken Grits

Afton, Mich. (Limestone), per ton	1.75
Belfast, Me.—(Limestone), per ton	‡10.00
Chico and Bridgeport, Tex.—Hen	¶9.00
Baby chick, per ton	¶8.00
Danbury, Conn.; Adams, Ashley Falls, and West Stockbridge, Mass. (Limestone	‡7.50@*9.00
Davenport, Ia.—(Limestone) bags, per ton	6.00
Easton, Penn.—In bags	8.00
El Paso, Tex.—Per ton	1.00
Knoxville, Tenn.—Per bag	1.25
Los Angeles, Calif.—Per ton, including sacks:	
Feldspar	14.00
Gypsum	7.50
Marion, Va.—(Limestone), bulk, 5.00; bagged, 6.50; 100-lb. bag	.50
Middlebury, Vt.—Per ton	10.00
Randville, Mich.—(Marble), bulk	6.00
Rocky Point, Va.—(Limestone), 100-lb. bags, 50c; sacks, per ton, 6.00; bulk	5.00
Seattle, Wash.—(Gypsum), bulk, per ton	10.00
Tuckahoe, N. Y.	8.00
Waukesha, Wis.—(Limestone), per ton	8.00
Wisconsin Points—(Limestone), per ton	15.00
Winona, Minn.—(Limestone), sacked, per ton, $8.00; bulk, per ton	6.00

*L.C.L. †Less than 5-ton lots. ‡C.L. ¶100-lb. bags.

Sand-Lime Brick

Prices given per 1000 brick f.o.b. plant or nearest shipping point, unless otherwise noted.

Albany, Ga.	10.00@11.00
Anaheim, Calif.	10.50@11.00
Barton, Wis.	10.50g
Boston, Mass.	17.00*
Brighton, N. Y.	19.75*
Brownstone, Penn.	11.00
Dayton, Ohio	12.50@13.50
Detroit, Mich.	13.00@16.00*d
Farmington, Conn.	13.00
Flint, Mich.	18.00†
Grand Rapids, Mich.	12.50
Hartford, Conn.	14.00@19.00*
Jackson, Mich.	13.00
Lakeland, Fla.	10.00@11.00
Lake Helen, Fla.	9.00@12.00
Lancaster, N. Y.	12.50
Madison, Wis.	12.00@12.50a
Mishawaka, Ind.	11.00
Milwaukee, Wis.	13.00*
Minneapolis, Minn.	10.00
New Brighton, Minn.	10.00
Pontiac, Mich.	12.50@15.00*
Pontiac, Mich.	11.00
Portage, Wis.	15.00
Prairie du Chien, Wis.	18.00@22.50
Rochester, N. Y.	19.75
Saginaw, Mich.	13.50
San Antonio, Texas	12.50@14.00
Sebewaing, Mich.	12.50
Sioux Falls, S. Dak.	13.00
South River, N. J.	13.00
Syracuse, N. Y.	18.00@20.00
Toronto, Canada (f)	†15.00*
Wilkinson, Fla.	12.00@16.00
Winnipeg, Canada	15.00

*Delivered on job. †5% disc., 10 days. ¶Dealers' price. (a) Less 50c discount per M. 10th of month. (d) 5% disc., 10th of month. (e) Delivered in city limits. (f) F.o.b. yard, 12.50. (g) Delivered Milwaukee, 13.00.

Portland Cement

Prices per bag and per bbl., without bags, net in carload lots.

	Per Bag	Per Bbl.
Albuquerque, N. M.		3.70
Atlanta, Ga.		2.35
Baltimore, Md.		2.25@2.65
Birmingham, Ala.		2.10
Boston, Mass.	.68¼	2.33@2.73
Buffalo, N. Y.	.62½	2.10@2.50
Butte, Mont.	.90¼	3.61
Cedar Rapids, Iowa		2.24
Charleston, S. C.		2.35
Cheyenne, Wyo.	.64	2.56
Chicago, Ill.	.51¼	2.05
Cincinnati, Ohio		2.22
Cleveland, Ohio		2.24
Columbus, Ohio		2.22
Dallas, Texas		1.80
Davenport, Iowa		2.24
Dayton, Ohio		2.22
Denver, Colo.	.63¾	2.55
Des Moines, Iowa		2.05
Detroit, Mich.		1.95
Duluth, Minn.		2.04
Houston, Texas		1.90
Indianapolis, Ind.	.54¾	2.19
Jackson, Miss.		2.04
Jacksonville, Fla.		2.20
Jersey City, N. J.		2.13@2.53
Kansas City, Mo.		1.92
Los Angeles, Calif.	.62½	2.50
Louisville, Ky.	.55½	2.22
Memphis, Tenn.		2.04
Milwaukee, Wis.		2.20
Minneapolis, Minn.		2.12@2.22
Montreal, Que.		1.60
New Orleans, La.		2.07
New York, N. Y.	.60¾	2.03@2.43
Norfolk, Va.		2.47
Oklahoma City, Okla.		2.46
Omaha, Neb.		2.36
Peoria, Ill.		2.22
Philadelphia, Penn.		2.21@2.61
Phoenix, Ariz.		3.91*
Pittsburgh, Penn.		2.04
Portland, Colo.		2.80
Portland, Ore.‡		2.90a
Reno, Nev.‡		3.41a
Richmond, Va.		2.40@2.80
Salt Lake City, Utah	.70¼	2.81
San Francisco, Calif.‡		2.71a
Savannah, Ga.		2.50
St. Louis, Mo.		1.95
St. Paul, Minn.	.48¾	2.12@2.22
Seattle, Wash.		2.50†
Tampa, Fla.		2.25
Toledo, Ohio		2.20
Topeka, Kan.		2.41
Tulsa, Okla.		2.33
Wheeling, W. Va.		2.52
Winston-Salem, N. C.		2.29

Mill prices f.o.b. in carload lots, without bags, to contractors.

	Per Bag	Per Bbl.
Albany, N. Y.	.43¾	1.75
Bellingham, Wash.		2.10
Buffington, Ind.		1.80
Chattanooga, Tenn.		2.45*
Concrete, Wash.		2.35
Davenport, Calif.		2.05
Hannibal, Mo.		1.90
Hudson, N. Y.		1.75
Leeds, Ala.		1.65
Lime and Oswego, Ore.		2.50‡
Mildred, Kan.		2.35
Nazareth, Penn.		2.15
Northampton, Penn.		1.75
Richard City, Tenn.		2.05
Steelton, Minn.		1.85
Toledo, Ohio		2.20
Universal, Penn.		1.80

NOTE—Add 40c per bbl. for bags.
*Includes sacks. ‡10c discount, 15 days.
†10c discount 10 days.
(a) Includes cloth sacks returnable at 10c each.

Gypsum Products—CARLOAD PRICES PER TON AND PER M SQUARE FEET, F.O.B. MILL

	Crushed Rock	Ground Gypsum	Agricultural Gypsum	Stucco Calcined Gypsum	Cement and Gauging Plaster	Wood Fiber	Gauging White	Plaster Sanded	Cement Keene's	Finish Trowel	—Plaster Board— ¼x32x 36". Per M Sq. Ft.	—Plaster Board— ⅜x32x 36". Per M Sq. Ft.	Wallboard, ⅜x32 or 48". Lengths 6'-10'. Per M Sq. Ft.
Acme, Tex.	1.70	4.00	4.00	4.00	4.00	4.50	.....	.....	.....	.....	.....	15.00	20.00
Arden, Nev., and Los Angeles, Calif.	3.00	8.00u	8.00u	10.70u	10.70u	.....	.....	.....	.....	11.70u	.....	.....	.....
Blue Rapids, Kan.	1.70	4.00	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Centerville, Iowa	3.00	10.00	15.00	10.00	10.00	10.50	10.00	.....	.....	.....	.....	.....	.....
Des Moines, Iowa	3.00	8.00	9.00	10.00	10.00	10.50	13.50	.....	.....	13.50	.....	15.00	20.00
Detroit, Mich.	.....	.....	.....	.....	14.30o	12.30m	13.50	12.00	24.00	22.00	18.00	21.00	30.00
Delawanna, N. J.	.....	.....	.....	.....	.....	.....	.....	m9.00@11.00o	.....	.....	.....	.....	.....
Douglas, Ariz.	.....	.....	6.00	14.50	15.00	.....	.....	7.25	.....	.....	.....	.....	.....
Fort Dodge, Iowa	1.70	4.00	6.00	9.00	9.00	9.50	18.00	.....	30.00	.....	13.00	14.00	.....
Grand Rapids, Mich.	2.65	4.00	6.00	6.00	9.00	9.00	.....	.....	.....	19.00	.....	.....	.....
Gypsum, Ohio	1.70@3.00	4.00	6.00	7.00@9.00	9.00	9.00	17.65	.....	22.75	19.00	12.00	15.00	20.00
Los Angeles, Calif.	5.00	7.50m	7.50m	8.00o	11.00m	.....	19.00	7.00	24.50	19.00	.....	15.00	18.00
Medicine Lodge, Kan.	1.70	4.00	.....	.....	.....	.....	.....	.....	.....	11.00m	.....	15.00	20.00@25.00
Oakfield, N. Y.	2.50	.....	.....	6.00	8.00	8.00	.....	.....	15.00	.....	.....	.....	27.50v
Port Clinton, Ohio	3.00	4.00	6.00	10.00	9.00	9.00	21.00	6.50	.....	.....	.....	15.00	20.00
Portland, Colo.	.....	.....	.....	10.00	.....	.....	.....	7.00	30.15	20.00	.....	.....	.....
San Francisco, Calif.	.....	.....	9.00	13.40	14.40	.....	15.40	.....	.....	.....	.....	20.00	30.00
Seattle, Wash. (b)	6.00	10.00	10.00	13.00	.....	.....	.....	.....	.....	.....	.....	.....	.....
Winnipeg, Man.	5.00	5.00	7.00	13.00	14.00	14.00	.....	.....	.....	.....	.....	.....	.....
											20.00	20.00	33.00

NOTE—Returnable bags, 10c each; paper bags, 1.00 per ton extra (not returnable). (a) Hardwall plaster, 13.00; casting finishing, molding, 14.00. (b) Calacoustic plaster 10.00 at mill; (m) includes paper bags; (o) includes jute sacks; (u) includes sacks. (v) retail 35.00.

Market Prices of Cement Products

Concrete Block

Prices given are net per unit, f.o.b. plant or nearest shipping point

City or shipping point	Sizes 8x8x16	8x10x16	8x12x16
Camden, N. J.	17.00		
Cement City, Mich.		5x8x12—55.00¶	
Chicago District¶	180.00@210.00a	230.00@260.00a	280.00@330.00a
Columbus, Ohio	16.00		
Detroit, Mich.	.15@ .17†		.24@.26†
Forest Park, Ill.	21.00*		
Grand Rapids, Mich.	15.00*		
Graettinger, Iowa	.18@ .20		
Indianapolis, Ind.	.10@ .12a		
Los Angeles, Calif.	4x8x12—5.00*		
Olivia and Mankato, Minn.	9.50b		
Somerset, Penn.	.18@ .20		
Tiskilwa, Ill.	.16@ .18†		
Yakima, Wash.	20.00*		

*Price per 100 at plant. †Rock or panel face. (a) Face. ‡Delivered. ¶Price per 1000. (b) Per ton. (c) Plain. (d) 5x8x12—65.00 M, 5½x8x12—68.50 M.

Cement Roofing Tile

Prices are net per square, carload lots, f.o.b. nearest shipping point, unless otherwise stated.

Camden and Trenton, N. J.—8x12, per sq.	
Red	15.00
Green	18.00
Chicago, Ill.—Per sq.	20.00
Detroit, Mich.—5x8x12, per M	67.50
Houston, Texas—Roofing Tile, per sq.	25.00
Indianapolis, Ind.—9x15-in.	Per sq.
Gray	10.00
Red	11.00
Green	13.00
Waco, Texas:	Per sq.
4x4	.60

Cement Building Tile

Cement City, Mich:	
5x8x12, per 100	5.00
Chicago District (Haydite):	
4x 8x16, per M	130.00
8x 8x16, per M	200.00
8x12x16, per M	275.00
Columbus, Ohio:	
5x8x12, per 100	6.50
Detroit, Mich.:	
5½x8x12, per M	75.00
Grand Rapids, Mich.:	
5x8x12, per 100	8.00
Longview, Wash.:	
4x6x12, per 100	5.00
4x8x12, per 100	6.25
Mt. Pleasant, N. Y.:	
5x8x12, per M	78.00
Houston, Texas:	
5x8x12 (Lightweight), per M	80.00
Pasadena, Calif. (Stone Tile):	Per 100
3½x4x12	3.00
3½x6x12	4.00
3½x8x12	5.50
Tiskilwa, Ill.:	Per 100
8x8	15.00
Wildasin Spur, Los Angeles, Calif. (Stone-Tile):	Per 1000
3½x6x12	50.00
3½x8x12	60.00
Prairie du Chien, Wis.:	
5x8x12	82.00
5x4x12	46.00
5x8x 6 (half-tile)	41.00
5x8x10 (fractional)	82.00
	Each
Yakima, Wash. (Building Tile):	
5x8x12	.10

Cement Drain Tile

Graettinger, Iowa.—Drain tile, per foot: 5-in., .04½; 6-in., .05½; 8-in., .09; 10-in., .12½; 12-in., .17½; 15-in., .35; 18-in., .50; 20-in., .60; 24-in., 1.00; 30-in., 1.35; 36-in.	2.00
Longview, Wash.—Drain tile, per foot: 3-in., .05; 4-in., .06; 6-in., .10; 8-in., .15; 10-in.	.20
Olivia and Mankato, Minn.—Cement drain tile, per ton	8.00
Tacoma, Wash.—Drain tile, per M:	
3 in.	40.00
4 in.	50.00
6 in.	75.00
8 in.	100.00
Waukesha, Wis.—Drain tile, per ton	8.00

Concrete Brick

Prices given per 1000 brick, f.o.b. plant or nearest shipping point.

	Common	Face
Appleton, Minn.	22.00	25.00@40.00
Baltimore, Md. (Del. according to quantity)	15.50	22.00@50.00
Camden and Trenton, N. J.	17.00	
Chicago District	14.00	
Columbus, Ohio	16.00	17.00
El Paso, Tex. — Clinker	13.00	13.00
Ensley, Ala. ("Slagtex")	9.00@12.00	
Eugene, Ore.	25.00	35.00@75.00
Forest Park, Ill.		37.00
Friesland, Wis.	22.00	32.00
Longview, Wash.*	15.00	22.50@65.00
Los Angeles, Calif.	12.50	
Milwaukee, Wis.	14.00	30.00
Mt. Pleasant, N. Y.		14.00@ 23.00
Omaha, Neb.	18.00	30.00@ 40.00
Pasadena, Calif.	10.00	
Philadelphia, Penn.	14.75	
Portland, Ore.	17.50	23.00@ 55.00
Mantel brick—100.00@150.00		
Prairie du Chien, Wis.	14.00	22.50@ 25.00
Rapid City, S. D.	18.00	30.00@ 35.00
Waco, Texas	16.50	32.50@125.00
Watertown, N. Y.	20.00	35.00
Westmoreland Wharves, Penn.	14.75	20.00
Winnipeg, Man.	14.00	22.00
Yakima, Wash.	22.50	

*40% off List.

Texas Still Agitating a State Cement Plant

COMPLYING with a resolution adopted by the legislature at its last regular session, the State Board of Control has investigated the matter of the state constructing and operating its own cement manufacturing plant. The board will make its report to the legislature which will meet next January. Several sites for the proposed plant are available, it was stated by members of the board. A large demand for cement has been created by the state highway department in the construction of concrete roads, and the product of the proposed plant would be largely used for this, it was stated.

R. B. Walthall, chairman of the Board of Control, said that approximately $500,000 would be necessary to build and equip a plant of 500 bbl. daily capacity, $850,000 for a 1000-bbl. plant and $1,500,000 for a 2000-bbl. plant. Convict labor probably would be used in the plant and the institution thus would provide occupation for prisons as well as effect a saving to the state, Mr. Walthall claimed.

Minnesota Roofing Granule Plant Expands

WALTER W. BOWE of Duluth, Minn., of the Bowe-Burke Mining Co. has the contract for quarrying the stone for the Emeralite Surfacing Products Co. plant west of Ely, Minn. The Emeralite company has heretofore done its own quarrying by hand, but the method was causing delay in the delivery of the crushed stone.

Mr. Bowe is installing a crusher, belt conveyor and a small electric shovel and other equipment. The crusher will facilitate the rock to the plant crushers in a more workable size by means of the belt conveyor. The electric shovel will keep the crusher fed to its capacity.

Ely greenstone is the product used and is being furnished to roofing manufacturers to the extent of several carloads a week. This greenstone has been found color proof and very much in demand.

Clyde M. Pearce, formerly of the Minnesota Sintering Co. at Crosby, Minn., on the Cuyuna range, is superintendent for Mr. Bowe.—*Ely* (Minn.) *Miner*.

Current Prices Cement Pipe

Prices are net per foot f.o.b. cities or nearest shipping point in carload lots unless otherwise noted

Culvert and Sewer	4 in.	6 in.	8 in.	10 in.	12 in.	15 in.	18 in.	20 in.	22 in.	24 in.	27 in.	30 in.	36 in.	42 in.	48 in.	54 in.	60 in.
Detroit, Mich.								15.00 per ton									
Detroit, Mich. (c)																	
Sewer	.10	.12	.22	.30	.40	.60	.90	1.20	.....	1.75	2.00	2.50	3.30	4.50	5.75	6.50	8.00
Culvert	.....	.....	.....	.....	.95	1.25	1.60	.....	.....	2.25	2.50	3.00	3.50	5.00	6.50	8.00	10.00
Grand Rapids, Mich.	4 in. to 12 in., 72% off standard sewer price list; 15 in., 65% off; 18 in. to 24 in., 62% off; 27 in. to 36 in., 60% off																
Houston, Texas	.....	.19	.28	.43	.55½	.90	1.30	.....	1.70†	2.20	.....	.....	.....	.....	.....	.....	.....
Indianapolis, Ind. (a)	.....	.....	.....	.75	.85	.90	1.15	.....	.....	1.60	.....	2.50	.....	.....	.....	.....	.....
Longview, Wash.	Sewer pipe 40% off list; culvert—list																
Mankato, Minn. (b)	.....	.....	.....	.....	.....	.....	.....	.....	.....	1.50	1.75	2.50	3.25	4.25	.....	.....	.....
Newark, N. J.	6 in. to 24 in., $18.00 per ton																
Norfolk, Neb. (b)	.....	.....	.....	.90	1.00	1.13	1.42	.....	.....	2.11	.....	2.75	3.58	.....	6.14	.....	7.78
Olivia, Mankato, Minn.	12.00 per ton																
Paullina, Iowa‡	.....	.....	.....	.....	.....	.....	.....	2.25	.....	2.11	.....	2.75	3.58	.....	6.14	.....	7.78
Somerset, Penn.	.....	.....	.....	.....	1.08	1.25	1.65	.....	.....	2.50	.....	3.65	4.85	7.50	8.50	.....	.....
Tiskilwa, Ill (rein.)	.....	.....	.....	.75	.85	.95	.70	1.55	.....	.....	.....	.....	.....	.....	.....	.....	.....
Tacoma, Wash.	.15	.18	.22½	.30	.40	.55	.75	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Wahoo, Neb. (b)	.....	.....	.....	.....	.95	.....	1.27	.....	.....	2.01	.....	2.73	3.78	4.58	6.24	7.19	8.11
Yakima, Wash.	.....	.....	.....	.....	.....	.....	1.42	.....	.....	2.11	.....	2.75	3.58	4.62	6.14	6.96	7.78

(a) 24-in. lengths. (b) Reinforced. (c) Delivered on job; 5% discount, 10th of month. †21-in. diam. ‡Price per 2-ft. length.

SITE OF
THE MERCHANDISE MART
THE LARGEST BUILDING IN THE WORLD
ALSO LOCATION OF
CHICAGO & NORTHWESTERN RAILWAY CO.
INBOUND AND OUTBOUND FREIGHT STATION

Self-unloading boat delivering cement for the construction of the Merchandise Mart beside the Chicago river, at Chicago

Manitowoc Portland Delivers Cement by Pumping from Boat to Site of World's Largest Building

A BIG steel boat, which might be mistaken for a torpedo boat, steamed into the Chicago River recently and pumped with Fuller-Kinyon pumps 2,000,000 lb. of cement a distance of 135 ft. and up in the air 75 ft. from the hoppers on the boat through 5-in. pipes into a big hopper on the site of the Merchandise Mart, which is to be the world's biggest business building.

This was the first time that building materials had been carried by boat into the Chicago river and landed direct to the site of a big building project, and also the first time that cement ever has been elevated so high for mixing. This boat, the *Daniel McCool*, is the only one of its kind in the world, and was designed about a year and a half ago by C. C. West, president of the Manitowoc Portland Cement Co. of Manitowoc, Wis., who is also president of the Manitowoc Engineering Works shipbuilding corporation. (The *Daniel McCool* was described in ROCK PRODUCTS, October 15, 1927). It took seven hours to complete the transfer of the ship's cargo to the construction company's bins.

This boat has carried cement to Chicago before, but it always has been conveyed to the silos of the cement company on Fullerton avenue and then transported by truck to the scene of building operations. The first boat load of cement delivered was for the 10 miles of caissons—450 in number—which are being driven for the foundation of the world's largest business building.

The big 75-ft. high bin is another revolutionizing factor in the speeding of great building projects. After the cement has been piped into the hopper of the bin, gravel and sand are conveyed into separate compartments and then the cement, gravel, sand and water are lowered by gravity into the mixer on another floor of the bin, after they have been weighed on a scale in the bin between the hopper and mixer. From there the mixture is lowered to the ground floor, where it is ready for filling the caissons.

From now on it is expected that this boat will make two or three trips a week until 100,000 bbl. (or about 38,000,000 lb.) of cement have been transported from Manitowoc to Chicago—the amount it is figured will be necessary to fill the 450 caissons.

Piedmont Quarries Incorporated at Salisbury, N. C.

THE Piedmont Quarries is a new company just chartered by the secretary of state, the incorporators being M. N. Hedrick, Thomas White, T. L. Hedrick, and others, of Salisbury. The authorized capital stock is $100,000, with $10,000 subscribed.

The company will mine, quarry and market stone, granite and other minerals, and do a special business in crushed stone. It has taken over quarries near Winston-Salem, N. C., having purchased these from C. M. Thomas of Winston-Salem. These quarries were formerly operated but for the past several years have not been developed. —*Salisbury* (N. C.) *Post.*

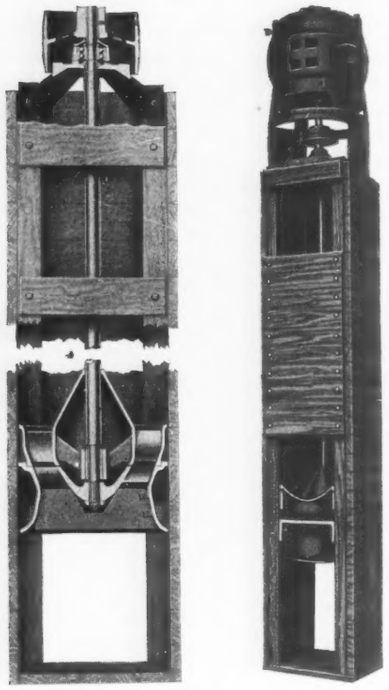
Communities Protest Against Cement Dust

FOUR townships and two towns are joining in the signing of a petition to protest to the Councils of Conshohocken and West Conshohocken against the alleged deposit of cement dust which, it is claimed, falls over a radius of almost five miles from the Valley Forge cement plant, in West Conshohocken, Penn.

The petition claims that the plant is a menace to health, injures real estate values, damages vegetation and disfigures historic hills of the section. The communities protesting include Conshohocken, West Conshohocken and Lower Merion, Upper Merion and Plymouth and Whitemarsh townships.—*Reading* (Penn.) *Eagle.*

George Allen, superintendent of construction; C. A. Welles, manager of the Merchandise Mart, and C. C. West, president of the Manitowoc company and designer of the "Daniel McCool," on the boat during the unloading

New Machinery and Equipment



New screw pump for low heads

Screw-Type Pump for Low Heads and Large Volumes

FAIRBANKS, MORSE & CO., Chicago, have brought out a new screw pump for handling large volumes of water at low heads with low installation costs. The pump was originally designed for drainage work, and is known as the "Everglades," obtaining its name because it was intended for use in such drainage work as is found in the Everglades region of Florida. However, it finds many uses in other lines than drainage and irrigation, notably in quarries and gravel pits for removing rain water and seepage.

The pump is a vertical unit, consisting of cast iron spiders, carrying a "Wood" screw-type impeller and diffuser, and constructed in such manner that four wooden corner posts are fastened to the spider and the sides boarded up to these posts. The height and direction of discharge is arranged by the placing of the side boards. The pump is placed vertically in the water and arranged to discharge over the bank or to a flume. It is claimed that this new unit eliminates the churning frequently found in other low-head screw pumps, and is more efficient.

The pump is adapted for direct connection to vertical motors or for belt drive from internal combustion engines or motors, using a ¼-twist belt or a gear on top of the unit.

Experience Records with High Alumina Kiln Linings

PRIOR to May, 1926, three to five months was the average life of high-grade fireclay brick in the hot zones of kilns in a prominent western cement plant. In May, 1926, in an effort to reduce refractory costs, this company lined the hot zones of nine kilns with "Arcofrax" high alumina brick, made by the General Refractories Co., Philadelphia, Penn.

Following is a record of these hot zone linings, according to the refractory manufacturer:

10-FT. DIAMETER KILNS

No. 1 Kiln—Lined with "Arcofrax" high alumina brick, May, 1926.
No. 2 Kiln—Lined with "Arcofrax" high alumina brick, May, 1926.
No. 3 Kiln—Lined with "Arcofrax" high alumina brick, May, 1926.

These three "Arcofrax" hot zone linings are still in operation, after more than 22 months' actual service, and are apparently good for some time to come.

8-FT. DIAMETER KILNS

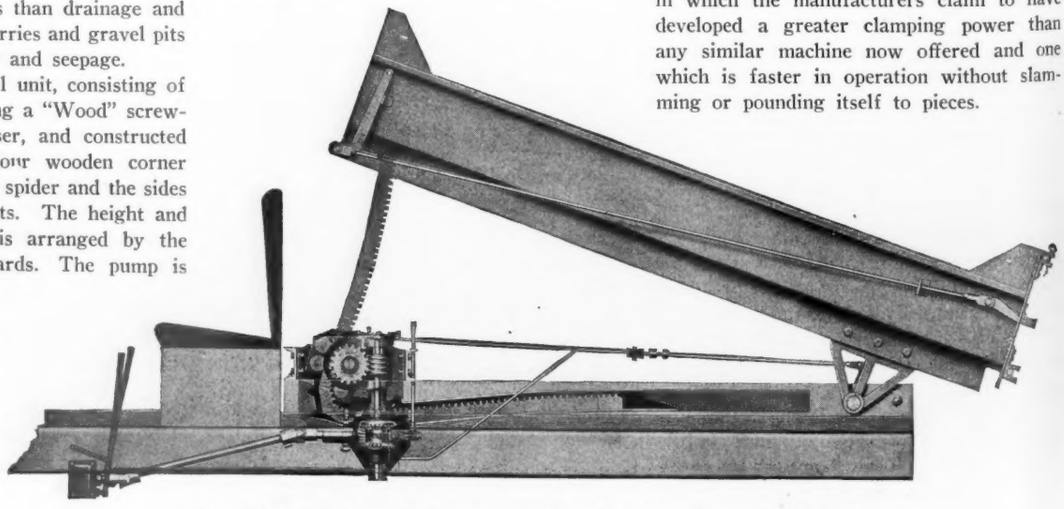
No. 2 Kiln—Hot zone lined with "Arcofrax" high alumina brick in May, 1926. Ran until May 15, 1927—12 months' actual service.
No. 8 Kiln—Hot zone lined with "Arcofrax" high alumina brick in May, 1926. Ran until October 1, 1927—16 months' actual service.
No. 1 Kiln—Hot zone lined with "Arcofrax" high alumina brick in May, 1926.
No. 3 Kiln—Hot zone lined with "Arcofrax" high alumina brick in May, 1926.
No. 4 Kiln—Hot zone lined with "Arcofrax" high alumina brick in May, 1926.
No. 7 Kiln—Hot zone lined with "Arcofrax" high alumina brick in May, 1926.

After 22 months' actual service, the hot zone linings in Kilns Nos. 1, 3, 4 and 7 are still in service and apparently good for some time to come.

Small sharpener for drill steel

Small Size Drill Steel Sharpener

A NEW small size drill steel sharpener has just been announced by the Gardner-Denver Co. of Denver, Colo., manufacturers of rock drills, compressors and pumps. This new sharpener, which has been designated as "Model DS-3," is a twin cylinder machine in which the manufacturers claim to have developed a greater clamping power than any similar machine now offered and one which is faster in operation without slamming or pounding itself to pieces.



Power dump body which has a number of new and improved features

New Power Dump Body

THE DITWILER MANUFACTURING CO., Galion, Ohio, have announced a new power dump body for motor trucks. The hoisting mechanism is claimed to be a new and unusual feature of this body. It is an articulated rack, with teeth which mesh into the final spur gear drive. As the body is lowered the extra length of the rack passes back into a dust-tight case. In the hoisting position, at a slight curve, the rack is rigid and strong enough to carry twice the regular load of light or medium weight trucks, it is claimed. The hoist has automatic construction with alloy steel parts, machine cut gears operating in oil within an oil-tight case and there are bronze bushings and ball bearings. Double bevel gears and worm gearing are used in power transmission. The point of lift at the center of the front of the body is claimed to be the logical point for easy lighting, and it is stated that the new hoist uses only 5% of the power available at the transmission from the motor. The new unit for installation on the Chevrolet chassis is being marketed by Hercules Products, Inc., of Evansville, Ind.

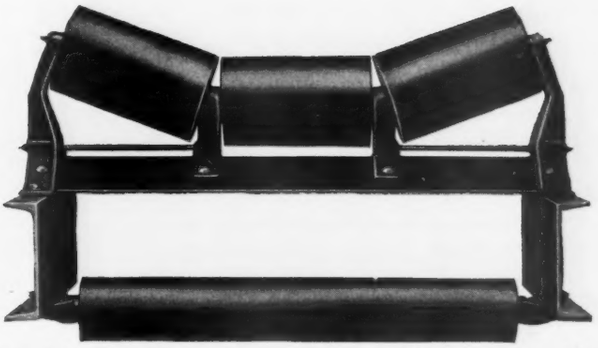
New Belt Conveyor Idler

THE Fairfield Engineering Co., Marion, Ohio, have announced a new belt conveyor idler for which they claim lifetime service. One of the particular features of the new idler is the use of the de Lavand centrifugally cast iron pipe for the roller. It is claimed that this pipe is very dense, is free from blow holes and slag pockets, and due to the uniform wall thickness and true shape, it runs true and without vibration. Timken bearings are used throughout, and lubrication is of the direct high-pressure type. It is stated that the grease connections are all easily accessible, and have dust-proof grease seals. There is no grease pocket outside the grease seal washer, so it is claimed that the new idler will not throw grease. All of the rollers are interchangeable. The announcement states that the idler is mounted on a sturdy self-cleaning base, which can be furnished at an angle tilting in the direction of the belt to insure a true-running belt.

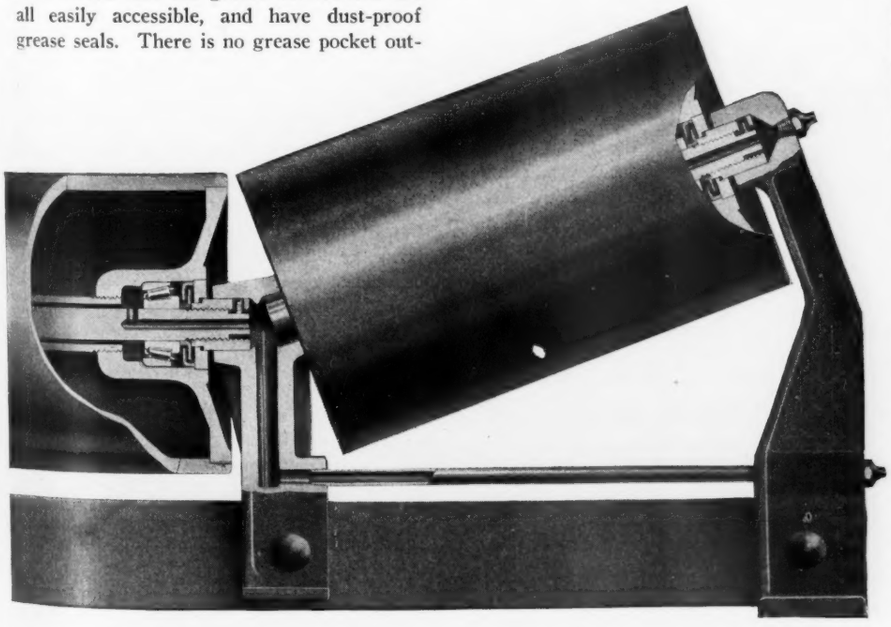
The face of the return roller supports the belt 1½ in. above the bottom flanges of the stringer channels, giving good belt clearance above the supporting frame cross members. Oscillating bearings are not required or used, so return rollers can be set to properly train the belt.

The design of the idler is the work of Earl D. Stearns, who recently joined the Fairfield company as vice-president. Mr. Stearns was formerly president of the Stearns Conveyor Co. of Cleveland, Ohio, and is known in the industry through more than 20 years experience on conveying problems.

New hoist which uses welded chain



Complete assembly of the new improved belt conveyor idler



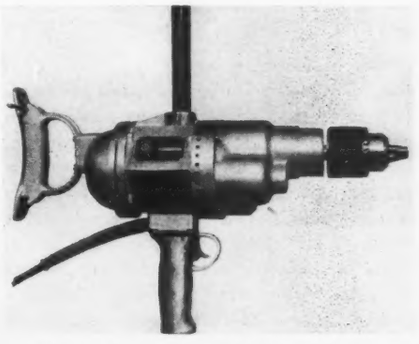
View of the new conveyor idler showing the essential parts in cross section

New Chain Hoist

THE Chisholm-Moore Hoist Corp., Cleveland, Ohio, has announced a new direct differential hoist which is designated as the "Blue Boy." It is claimed this hoist is more efficient and it is also stated that it has been equipped with the Hercules Inswell electric welded load chain, which gives it a higher degree of safety. Because the extra heavy load sheaves, malleable iron yokes and drop-forged hook are painted blue and the Inswell chain is copper plated, the new "Blue Boy" has an unusually attractive appearance.

New Portable Electric Drill

BLACK AND DECKER CO., Towson, Md., have recently brought out a new ¾-in., heavy-duty, portable electric drill designed to meet the demand for a powerful drill of ¾-in. capacity to take straight shank drill bits. It is stated that the drill is equipped with a powerful motor which operates on direct or alternating current, and the armature and spindle thrust are mounted on ball bearings. There is a 3-jaw geared chuck for straight-shank bits, and it is claimed that holes up to ¾-in. in diameter can be drilled through the toughest steel with the drill. It is especially adapted for constant service work, but should find many uses around the plants and in the shops of the rock products field.



Heavy-duty, portable drill for use around the plant

Alton, Ill., Mourns Loss of Lime Industry

PASSING of the lime-burning industry in Alton scarcely a year ago opens a field of interesting reminiscence, for lime burning insofar as recorded history recounts was Alton's first manufacturing enterprise.

For a space of 110 years lime burning was an important industry here. It was the first manufacturing project in which a native raw material was converted into a finished product. The industry flourished amazingly, and ceased suddenly when it had reached its highest stage of commercial development in the hands of the Mississippi Lime and Material Co.

It was the verdict of the industrial chemist that brought an end to burning lime in Alton. Alton limestone was only 95% pure calcium carbonate, and when the Mississippi Lime and Material Co. found that it could produce a high calcium lime at its Ste. Genevieve, Mo., plant pure as Ivory soap, it eliminated its Alton kilns and centered here on its crushed stone and sand products.

Found Raw Materials Early in City's History

When Alton was first laid out, virtually 110 years ago, travelers and writers of the day were wont to comment on the almost inexhaustable supplies of basic raw materials. Timber, stone, sand and coal there were in abundance. The earliest industries of the town grew out of its advantageous location with respect to the supply of these raw materials.

Peck's Gazetter of 1831 says of Alton with respect to its natural supplies of raw materials:

"One of the finest bodies of timber in the state surrounds it for several miles in extent. Bituminous coal of good quality and in common use by blacksmiths exists in abundance, and but a short distance from this place. Inexhaustible beds of limestone of good quality for buildings and easily quarried, and a species of sandstone possessing a fine grain, which is quarried and dressed for monuments and architectural purposes. Here also is an abundance of that peculiar species of lime used for water cement."

And that the manufacture of lime was one of the first industries of the little frontier town is shown by an advertisement in the April 18, 1820, issue of the *Edwardsville Spectator*, the first newspaper of Madison county, which reads: "Any quantity of good unslaked lime may be had for 25 cents per bushel at Alton on the Mississippi. Matthias P. Ringer and Co."

Lime Burning Outlasted Lumber and Coal Industries

At least 10 years elapsed after lime was first burned in Alton that a steam sawmill was established and local timber was dressed by machine and converted into lumber. Almost as many years passed before coal, easily secured by stripping at points adjacent to the town, was put to commercial use. And it was many years before quarrying was engaged in on an important commercial scale, for the first stone was so easily had for building that the term of quarrying could scarcely be applied to the process of securing it. Sand was available at points on the river for the mere hauling.

But years after timber had been cut away to the point none was left to be commercially available, and for a considerable time after coal mining was locally abandoned, lime burning continued to flourish as an industry. And of the early day industries which had to do with Alton's supply of basic materials it may be said that only the stone and sand, and a more recent development, brick manufacturing, remain. These have advanced to a mature and efficient stage of commercial development and form an important section of Alton's industrial enterprises. The Mississippi Lime and Material Co. at its large plant turns out stone and sand for varied uses on a vast scale; the Reliance Quarry Co., with a different grade of stone, conducts an important business in the manufacture of whiting, and the Alton Brick Co., another large concern, specializes in its Alton plant in the manufacture of paving brick.—*Alton* (Ill.) *Telegraph.*

Utah Rock Asphalt Corp. Plans Aerial Tramway and Winter Operation

IMMEDIATE CONSTRUCTION of an aerial tramway, three miles in length, looms as a result of a visit by C. N. Power, president of the Utah Rock Asphalt Corp., to the properties of the company in Carbon county, Utah, recently, according to a local newspaper. The tramway which is proposed would cover the entire length of Water canyon near Sunnyside, eliminating a grade from the mouth of the canyon to the quarry of the asphalt corporation, much of which is a 25% grade.

Mr. Power feels that the induction of the tramway would make capacity production in the winter time practicable, with no lessening in production on account of snowfall.

Sunnyside has been a scene of heightened activity as a result of the operations of the new corporation. Much asphalt is being sold to concerns in the state of Utah, according to Henry H. Jones, general superintendent. Price is installing more than 1000 ft. of surfaced street, using rock asphalt as an agent.

Seven carloads of the crushed asphalt stone are being shipped to Chicago, where experiments will be conducted by officials to determine the utility as a surfacing agent in the fifth largest city of the world.

Mr. Jones states, that according to plans, based on orders of the organization, that he can foresee no letup in the activities of the corporation this winter.

Another Rock Asphalt Property Near San Antonio, Texas, To Be Developed

CONSTRUCTION of an extensive and modernly-equipped camp, preparatory to starting development work upon a deposit of limestone rock asphalt estimated to contain more than 15,00,000 tons, has been started in Uvalde county, west of San Antonio, by the Standard Rock Asphalt Co. of San Antonio. The company owns or has leased 4562 acres of land in Uvalde and Kinney counties upon which the deposit is located, according to J. C. Arnold of San Antonio, president. In connection with development of the rock asphalt deposits, the company will systematically lay out a townsite to serve its properties. The name for this town, which will primarily be a company proposition, has not been selected.

The company has a number of temporary buildings already on its property and has a great deal of machinery on the grounds. A deal has been closed for machinery to cost $20,000 more. All will be in readiness for actual mining in the very near future, Mr. Arnold said.

The company, with a few exceptions, is composed of San Antonians. In addition to Mr. Arnold as president, the officers are: Craig J. Adams, vice-president, and Ferd D. Wood, secretary and treasurer. Directors are: Mr. Arnold, Mr. Adams, Mr. Wood, J. J. Nix, Fred J. Tips, J. B. Arnold, Lester S. Whipple, A. A. Ririe, Dr. A. D. Nelson of Richland Springs, J. R. Mims of San Angelo and A. F. Clarkson of Sonora.

The tract to be developed was leased for 30 years from Maria W. James and the late John J. Stevens. It is 1400 ft. from the end of the Missouri Pacific R. R. track to the asphalt quarry. Officials of the Standard company are negotiating with the railroad for the building of a line to their property. It is estimated that 2800 ft. of railroad will be necessary to serve the property. At the same time buildings on the tract, which have been erected by the company to house its workmen and supplies, will be removed and all concentrated at the one point. In addition to permanent plant buildings, houses for the workmen, a hotel, the superintendent's house, commissary and other structures will be erected by the company. A supply yard will also be built in San Antonio.

Practically the entire deposit is at the top of the ground, making it easy to work, Mr. Arnold said. In many places the deposits are in high bluffs easily accessible. There will be practically no stripping necessary before the deposit can be developed. One tract of 130 acres has been prospected in the past, and A. A. Ririe, who is chief engineer, has estimated that there are approximately 6,800,000 tons of asphalt in sight. He has also estimated that it will cost but $1 per ton, at the maximum, to produce and load the asphalt on the cars.

News of All the Industry

Incorporations

Marlette Sand and Gravel Co., Marlette, Mich., $30,000. To produce and deal in gravel and sand.

Tidewater Gypsum Co., Houston, Texas, has increased its capital stock to $1,500,000.

James Stone Co., Richland, Texas, has increased its capital stock from $175,000 to $225,000.

Milone Concrete Co., New York, N. Y., $10,000. J. J. Pasquale, 3550 White Plains Ave.

Catawba Mica Corp., Newton, N. C., $100,000. Mark Zimtbaum and J. W. Yount.

California White Portland Cement Co., Eatontown, N. J., $1,000,000. To deal in cement. George J. Stillman, Eatontown.

Camargo Sand and Gravel Co., Woodward, Okla., $30,000. L. S. Fisher, Woodward, and V. R. French, Camargo.

Silver Mica Mining Corp., Burnsville, N. C. To mine and prepare mica. C. R. Hamrick, Burnsville, and Alexander Boddie, Miami, Fla.

Cooper Cement Block and Supply Co., Toronto, Canada, $50,000. To operate quarries and manufacture cement and cement products.

Garden City Sand Co., Chicago, Ill., an Illinois corporation, filed an affidavit designating Herschel B. Davis, Gary, Ind., as its Indiana agent.

North American Refractories Co., Wilmington, Del.; 1000 shares common stock, no par value. To produce and deal in sand, gravel and clay.

Sarnia Cement Products Co., Ltd., Point Edward, Ont. To manufacture and deal in cement, cement products, lime, etc.

Duquesne Slag Products Co., Pittsburgh, Penn., has received authorization from the secretary of state of West Virginia to transact business in that state.

Standard Rock Asphalt Co., San Antonio, Texas, $600,000. To mine limestone rock asphalt. F. D. Wood, secretary and treasurer, Brady Bldg., San Antonio.

Alburtis Stone and Sand Co., Alburtis, Penn., $30,000. Edwin E. Frantz and Eva L. Frantz of Allentown, Penn., and Morris W. Schmayer of Alburtis.

Lambertville Trap Rock Co., Newark, N. J.; 3000 shares, no par value. Edwin Adams and P. D. Elliot of Newark and Edwin Adams, Jr., of Essex Falls, N. J.

Lone Star Cement Co. of Virginia, Inc., Richmond, Va.; 10 shares, no par value. To manufacture and deal in cement. Holger Struckman, president, New York City.

Lone Star Cement Co. of Indiana, Inc., Indianapolis, Ind.; 100 shares, no par value. To manufacture and deal in cement. Jacob S. White, Burrell Wright and Edward J. Boleman.

Materials Producing Corp., Stoney Point, N. Y.; 200 shares of common stock, no par value. To produce and deal in building materials. Attorney, K. R. Thompson, 27 Williams St., New York City.

South Carolina Granite Corp., a Delaware corporation, has obtained a certificate of domestication to enable it to do business in South Carolina. The headquarters of the concern will be at Columbus, S. C.

Quarries

Georgia Limerock Co., Perry, Ga., which recently completed a new plant of 60 cars per day capacity, is reported to be planning to increase its output.

Indianapolis, Ind. Two new maps have been completed by the division of geology of the state conservation department for use by the stone industry of Indiana, according to Dr. W. N. Logan, state geologist, under whose direction the maps were compiled. One is a complete survey of the Indiana oolitic stone belt, showing the outcrop of building stone and the underlying formations. The other map shows the drainage of the district and the sites of quarries and mills. Richard Lieber, conservation director, points out that these maps will be of value in the future development of the stone industry, as they cover the principal producing areas in Owen, Monroe, Lawrence and Washington counties. The maps contain vertical sections showing the thickness of the stone in various sections of the area. Dr. Logan says a report to accompany the maps is in course of preparation and will be issued in the near future. This report will give a comprehensive discussion of the physical and chemical properties of the state. Other features to be discussed will include the origin of the deposit and methods of quarrying.

Sand and Gravel

Chicago and North Western R. R. has purchased an 86-acre tract near the city of De Smet, S. D., for a new gravel pit.

Boston Sand and Gravel Co., Boston, Mass., have recently acquired 27 acres on Stockbridge road in Scituate, Mass., adjoining the company's property there. The sand company has also purchased 45 acres at French and Hobart streets, Hingham, Mass.

Gilley Bros., Ltd., New Westminster, B. C., Canada, have built a new floating derrick equipped with two steam engines. One of the engines is of the Tyee donkey type, equipped with two-drum hoisting apparatus to operate the clamshell. The other engine has one drum and will control the boom. The machine will be operated at the various sand and gravel deposits of the firm and will also be used for unloading scows where facilities for this work are not available. It is equipped with a 6-in. centrifugal pump for dredging.

Chillicothe, Ohio.—A report in the *Chillicothe* (Ohio) *News-Advertiser* states that the Chillicothe Sand and Gravel Co., of that city, and also the American Aggregates Corp., are now taking over options on property near that city and it is expected that there will be considerable activity in that district within a short time. The report states the Chillicothe company and the American company are understood to be working together on the project, it being stated that the former is to secure 150 to 180 acres of land in the vicinity as a step toward consolidation with the other company. It is unofficially stated that the American Aggregates Corp. is taking over options on 100 acres of land.

Cement

Canada Cement Co., Montreal, Canada, will make alterations and additions to its plant at Hull, including the installation of new machinery, to cost $500,000.

Pennsylvania-Dixie Cement Corp., according to a Macon, Ga., newspaper, is contemplating increasing the capacity of its Clinchfield, Ga., mill, known as plant No. 2. Its present annual capacity is 1,250,000 bbl.

Diamond Portland Cement Co., Cleveland, Ohio, has removed its general offices from Cleveland to Middle Branch, Ohio, according to a recent announcement. A sales office will be maintained at 1818 Williamson building, in Cleveland.

Arkansas Portland Cement Co., Saratoga, Ark., is proceeding with construction work. This is a subsidiary of the Ideal Cement Co., Denver, Colo., and it is reported the plant will consist of one wet-process kiln and auxiliary equipment.

British Columbia Cement Co., Ltd., Victoria, B. C., is undertaking exploration work on its property on Texada Island preliminary to the quarrying of lime rock there. Facilities are being planned, and the company has applied for a foreshore lease.

Trinity Portland Cement Co., Dallas, Tex., which is doubling the capacity of its Fort Worth mill at a cost of $350,000, has let contracts for machinery as follows: Traylor Engineering and Manufacturing Co., 8x40-ft., 3-compartment mill; Reeves Bros., 11x300-ft. kiln; General Electric Co., all motors and motor controls. Plans and construction work are in charge of the Trinity company's own engineering staff headed by O. V. Bartholomew, Dallas.

Ottawa, Canada.—The Advisory Board of Tariff and Taxation will shortly hear the application of the Canadian Council of Agriculture, through its secretary, A. E. Darby, for the removal of the customs duty on cement. The agricultural council states that it is of the belief that the industry in Canada is in a position to compete with ouside manufacturers on a favorable basis and that outside competition would have a tendency to reduce prices and would thus stimulate the demand to such an extent that the industry would be compensated for the loss of profits. There is a duty of 8 cents per hundredweight effective on cement at the present time, and this is the tariff which the council hopes to have removed.

Cement Products

Spencer Cement Products Co., Spencer, Iowa: Receiver announces a 15 or 20% dividend to be paid stockholders in near future.

Woodlawn Cement Block Co., West Allis, Wis., operated by Paul Sikorra, has added quite an addition to its plant, for the manufacture of 16-in. block. Mr. Sikorra will have the new plant operating in a short time, and already has sufficient business "lined up" to keep him going for some time.

Gypsum

United States Gypsum Co.—Construction of a manufacturing unit to be located at 58th street and the Schuylkill river, southwest Philadelphia, Penn., is expected to get under way within the next week, according to an announcement made at Baltimore on September 21. The initial cost of the new plant has been estimated at $1,250,000, and the investment upon full completion is expected to surmount by a considerable margin the original figures. The new plant is expected to be in operation in July, 1929. It will function as a manufacturing and distributing unit for eastern Pennsylvania, southern New Jersey, Delaware, Maryland and the District of Columbia.

United States Gypsum Co. has promoted Arthur A. Frosdick, works manager of the Fort Dodge plant, to the Chicago offices. He will be succeeded by Fred J. Reinking, of Kansas City, it was announced. Mr. Frosdick has been in charge of the Ft. Dodge plant since September 21, 1927, when Cecil B. Pooler was promoted to the management of one of the mills in New York. The transfer takes Mr. Frosdick to the engineering department, where he will supervise part of the company's extensive construction program. Mr. Reinking has been in charge of the United States Gypsum Co.'s paper mill in Kansas City. He has been with the company for several years, most of the time in several eastern plants.

Lime

Pittsfield Lime and Stone Co., Pittsfield, Mass. A report in the *Pittsfield* (Mass.) *Eagle* states that Royal Bassett of New York City has filed a bill in the superior court asking that a receiver be appointed for the company.

Southern Lime Products Co., Cordele, Ga., has placed M. B. Sumner in charge of the Cordele offices of the company.

National Lime, Cement and By-Product Corp., Buffalo, N. Y., was represented by F. L. Hoff, president, and T. K. Morris of Pittsburgh, vice-president and general manager in an inspection of property owned by the company in the vicinity of Tuscambia, Ala., recently. It is reported a large lime plant costing $500,000 will be built on the property when the company has completed its plans for development, according to an announcement in a Tuscambia paper.

Miscellaneous Rock Products

Owl Creek Phosphate Co., Perry, Fla., is developing phosphate mines in Taylor county, has acquired 8150 acres at Penotis and is constructing a plant with daily capacity of 200 tons.

American Crystal Co., 1031 Schafield building, Cleveland, Ohio, will develop 380 acres of land at Caddo Gap, Ark., with output of 1 car of crystals per month; install pumps, motors, drills, etc.

Franklin Mineral Products Co., Franklin, N. C., John Davenport, general manager, will erect new mica grinding mill, comprising main one-story unit, 30x185 ft., with grading plant, 30x100 ft., boiler house and other buildings, to cost about $55,000 with machinery.

Dixie Mineral Products, Inc., W. H. Meachem, president, 1515 Duncan avenue, Chattanooga, Tenn., is erecting drying sheds, building for grinding plant and packing equipment; installing side tracks and tramways to mines; cost $75,000; 20,000 tons of clay will be processed and shipped annually; have floor space of 10,000 sq. ft.; machinery will be electrically operated and consist of grinders, driers, disintegrators and packing machinery; all building materials and equipment have been purchased.

Personals

Charles A. McKeand, former assistant to the president of the Florida Portland Cement Co., was elected recently to succeed L. P. Dickie as general manager of the Tampa Chamber of Commerce.

B. F. Affleck, president of the Universal Portland Cement Co., Chicago, Ill., and president of the Union League club, Chicago, was one of the principal speakers at a dinner given recently by the club to Herbert A. Richards, who is retiring from the office of British consul-general in Chicago.

Earle S. Philips, vice-president and manager of the Good Roads Machinery Co., Inc., Kennett Square, Penn., is making an extended trip to the Pacific coast to study conditions in the company's various sales territories, and visit its representatives and dealers.

H. H. Sherman has been appointed manager of the publicity department of the Chicago Pneumatic Tool Co., with headquarters at the general offices of the company, 6 East 44th St., New York City. Mr. Sherman joined the company in 1927 as assistant publicity manager, and has had many years' experience in industrial advertising and advertising agency work.

Sergt. E. J. Burkhardt of the transformer sales department, Wagner Electric Corp., St. Louis Mo., made his first parachute jump recently from a height of 2200 ft. above the St. Louis airplane field, from which Lindbergh made his historic flight to New York and then on to Paris last year. Sergeant Burkhardt is master photographer of the 110th Photo Section, 35 Division Air Service, Missouri National Guard, and although actively engaged in selling transformers for the Wagner Electric Corp., finds time to keep himself fit for active service as an aviator in the Missouri National Guards.

Manufacturers

Linde Air Products Co., New York City, announce a new oxygen producing plant located at 125 Settlement street, Akron, Ohio. The plant will be operated under the direction of A. Deagon, superintendent. The addition of this plant to the Linde chain brings the total up to 54.

The Falk Corp., Milwaukee, Wis., has announced the appointment of B. W. Rogers, 225 Central Savings and Trust building, Akron, Ohio, as their representative for Akron and environs. Mr. Rogers will handle Falk herringbone gears, speed reducers and flexible couplings.

Traylor Engineering and Mfg. Co., Allentown, Penn., has assigned Foster E. Benner to its Chicago sales office at 1414 Fisher Bldg., in the capacity of sales engineer. Mr. Benner has been connected with the main office of the company at Allentown for a number of years.

Trackson Co., Milwaukee, Wis., has appointed the New England Implement Co., Inc., 19 Jersey street, Boston, Mass., as a distributor for McCormick-Deering industrial tractors and their lines of related equipment. The same company at 22 Garden street, Worcester, Mass., will also act as a distributor for Trackson equipment.

Botfield Refractories Co., Philadelphia, Penn., announces the appointment of W. E. Tierney as representative in the South and Southwest territory, with headquarters at New Orleans. Mr. Tierney is a mechanical engineer and a graduate of Tulane university.

Lakey Foundry and Machine Co., Muskegon, Mich., announces an increase in its dividend rate from $1.20 per year to $2 per year, and an extra 10c per share for the quarter. The increased regular quarterly dividend of 50c and the extra dividend of 10c is made payable October 31 to stockholders of record October 20.

General Electric Co.'s orders for the three months ending June 30 amounted to $90,431,957, as compared with $78.105.247 for the corresponding quarter of 1927, an increase of 16%, President Gerard Swope has announced. For the six months ending June 30, orders received amounted to $170.357,797, as compared with $155,655 828 for the first six months of last year, or an increase of 9%.

Keller Tractor and Shovel Co., Inc., 5124 Braden avenue, Detroit, has been organized by Carl H. Keller and associates to distribute tractors of the Caterpillar Tractor Co., San Leandro, Calif.; gas and air shovels, cranes and draglines made by the Bucyrus-Erie Co., South Milwaukee, Wis., and earth moving machinery and snow plows manufactured by Baker Mfg. Co., Springfield, Ill.

International Combustion Engineering Corp., New York City, announces that negotiations have been completed for the purchase of the Hedges-Walsh Weidner Co. of Chattanooga, Tenn., a recent combination of the Casey-Hedges Co. and the Walsh and Weidner Boiler Co., two of the oldest boiler manufacturing companies in the United States.

The Byers Machine Co., Ravenna, Ohio, has its expansion program now well under way. Machinery and inventory of the Massillon, Ohio, plant, formerly the Massillon Power Shovel Co., has been transferred to the Ravenna plant, to which has been added the 15-acre site of the National Carbon Co., with a dozen buildings. Provision is being made for testing grounds for power shovels and cranes and according to H. C. Beckwith, president of the company, the complete expansion program involves a total of 20 acres

H. C. Beckwith

Van Dorn Electric Tool Co., Cleveland, Ohio, announces that E. J. Phillips, who has been selling Van Dorn products in Detroit, is now representing the company in the San Francisco territory. His place in Michigan will be filled by his brother, George Phillips. J. F. Spaulding has been transferred to the Baltimore territory to fill the vacancy resulting from the transfer of Jack Beggs from Baltimore to the home office in Cleveland.

Wagner Electric Corp., St. Louis, Mo., has announced the addition of R. W. Piper to their transformer sales division. Mr. Piper will cover the southeast district, including a section of West Viriginia and the states of Virginia, North Carolina, South Carolina, Alabama and Florida. H. D. Epting of the Philadelphia sales office has been transferred to the Atlanta sales office.

Continental Motors Corp., Detroit, Mich., announces the appointment of Robert Insley as chief of the recently established aeronautical division of the company. Mr. Insley has been for the past eight years assistant chief of the power plant branch, United States Air Corps materials division, Wright Field, Dayton, Ohio, and is widely known as an expert on aircraft engine production.

Lincoln Electric Co.'s salesmen from all parts of the United States and Canada gathered at the research laboratories of the company in Cleveland, Ohio, on September 14 and 15 to view the company's new developments in the design of electric arc welding equipment. Demonstrations and comparative tests were made showing the improved performance and the increased ease of operation of the newly equipped welders.

Lincoln Electric Co., Cleveland, Ohio, has opened a San Francisco office at 533 Market St. in charge of W. S. Stewart. L. P. Henderson, formerly of the Chicago office, has been transferred and put in charge of the Minneapolis district. Robert Notvest has been transferred from Kansas City to Indianapolis, where he will have charge of the Indianapolis district, and R. E. Mason has been sent to Kansas City to replace Mr. Notvest. L. L. Nye has been stationed at Akron, Ohio, under the direction of R. P. Tarbell, manager of the Cleveland district.

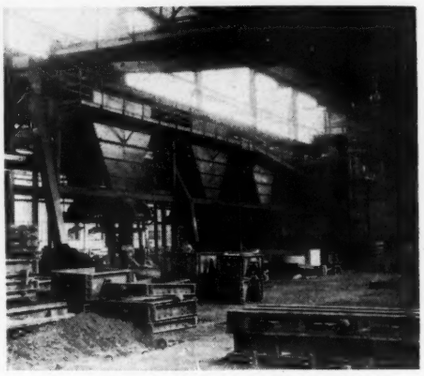
Timken Roller Bearing Co., Canton, Ohio, has announced the incorporation of a new company, known as the Timken Steel and Tube Co., which will take over the manufacture and selling of Timken steel and tubing. The headquarters and mills are in Canton, Ohio, with sales offices in Chicago, Los Angeles, Detroit and New York City. The officers are: H. H. Timken, chairman; M. T. Lothrop, president; J. W. Spray, vice-president; A. J. Sanford, vice-president in charge of sales; J. E. Daily, vice-president in charge of operations, and J. F. Strough, secretary and treasurer.

Burke Electric Co., Erie, Penn., at its recent annual stockholders meeting elected the following directors for the ensuing year: Alfred J. Hernsheim and Alexander H. Kridel of New York City; James Burke, Geo. R. Metcalf, J. C. Spencer, J. R. McDonald, Geo. H. Winkler, E. F. G. Faure, G. Irving Blake, Chas. H. Schum and R. W. DeLancey of Erie, Penn. A meeting of the new directors was held following the stockholders meeting, at which the following executive officers were elected: James Burke, chairman, board of directors; Geo. H. Winkler, president; R. W. DeLancey, vice-president; G. Irving Blake, treasurer; Chas. H. Schum, secretary, and C. J. Gibson, assistant treasurer.

Chain Belt Co., Milwaukee, Wis., after new financing, has placed its common stock on the market, hereafter to be listed on the Chicago Stock Exchange. The new financing consists of approximately 7000 shares of common stock, proceeds to be used to retire the preferred stock of the company. The common stock, with 120,000 shares outstanding, will then represent the company's entire capitalization. It is interesting to note that from a working organization of three men when the company first started operating in 1891, the organization has grown to 1200 employes, the company now occuping 317,000 sq. ft. of floor space and 65 acres of land on which the plants are built.

Mackintosh-Hemphill Co., Pittsburgh, Penn., has been reorganized, new interests having taken over the management of the company. The board of directors of the reorganized company are H. V. Blaxter, John W. Chalfant, Edwin Hodge, Jr., Herbert A. May, J. H. O'Neill, W. C. Rice and T. C. Ward, and the following officers have been elected: H. V. Blaxter, chairman of the board; F. H. Moyer, vice-president; W. C. Rice, treasurer; and D. H. Baum, secretary and assistant treasurer. The company was founded in 1803, and has acquired the A. Garrison Foundry Co., Pittsburgh, Penn., the Pittsburgh Iron & Steel Foundries, Midland, Penn., and the Woodward Machine Co., Wooster, Ohio.

Chicago Pneumatic Tool Co., New York City, has recently completed a large new modern foundry at Franklin, Penn., where gray iron castings for



New foundry which has been recently completed

compressors and engines will be made. The new foundry building, which is adjacent to the main plant, is 130 ft. wide by 220 ft. long, and a storage shed, 60 ft. wide by 330 ft. long, has also been erected. The new buildings and equipment represent an investment of over $400,000. The company also has large plants at Detroit, Mich., and Cleveland, Ohio.

Trade Literature

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Tractors. Illustrated announcement of the "Monarch 50" tractor produced by the Monarch Tractors Corp., a subsidiary of Allis-Chalmers. MONARCH TRACTORS CORP., Springfield, Ill.

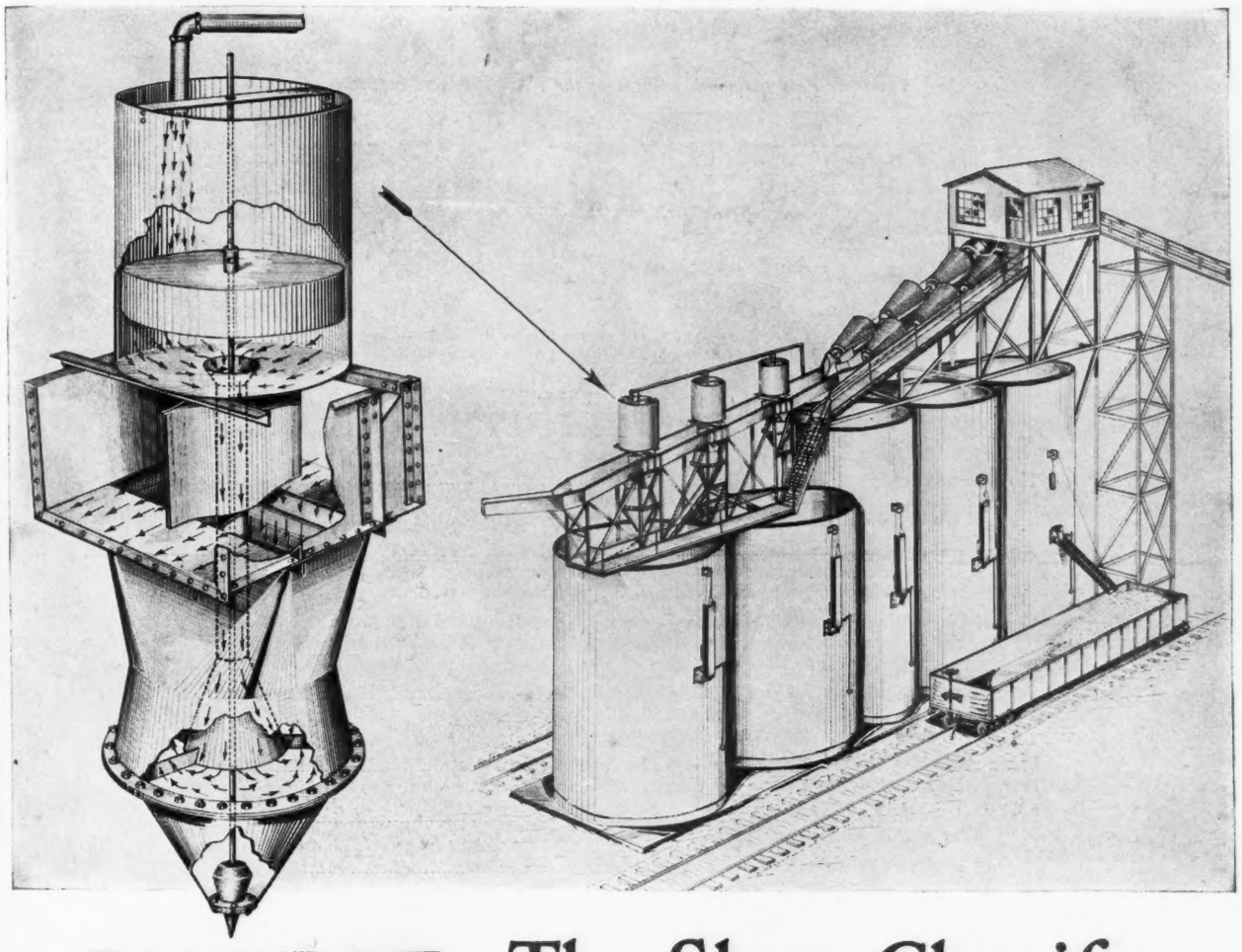
Low-Pressure Acetylene Generator. Illustrated bulletin on the company's "Carbic" low-pressure acetylene generator. OXWELD ACETYLENE CO., New York City.

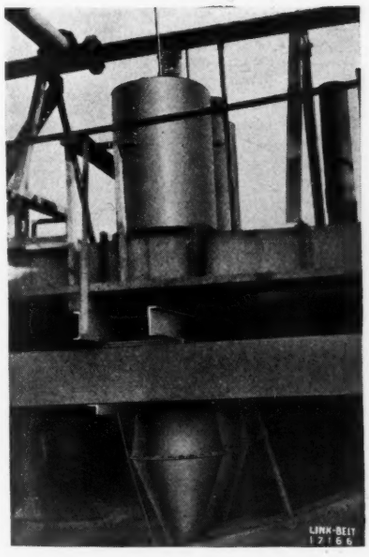
Bearing Construction in Motors. Illustrated **Bulletin No. 156** on the sleeve bearings and ball bearings used in the company's equipment. WAGNER ELECTRIC CORP., St. Louis, Mo.

"High Duty" Magnetic Clutches. Illustrated **Bulletin No. 72** on "High Duty" magnetic clutches, containing information and data on the application of the magnetic clutch. MAGNETIC MANUFACTURING CO., Milwaukee, Wis.

Cable Power Scrapers. Bulletin on cable power scrapers and slack line excavators for use with sand, stone, gravel and similar materials, illustrated with typical installation diagrams. ATLAS CONVEYOR CO.

Switches for Across-the-Line Starting. Illustrated announcement of type 20 switches for across-the-line starting, combining overload protection and single-phase protection. ELECTRIC CONTROLLER AND MFG. CO., Cleveland, Ohio.





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